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Flathead Basin Commission

1991-1992 Biennial Report

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FLATHEAD BASIN COMMISSION

1991-1992 BIENNIAL REPORT

February 1993

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The Flathead River near Kalispell.

LETTER FROM THE CHAIR

Dear Governor Racicot and the Montana Legislature:

The Flathead Basin Commission remains one of the most innovative creations of Montana state law. Representing as it does a variety of resource managing agencies and the public through appointed citizen members, the Commission provides a unique forum for issue discussion, public education and the building of much needed public consensus on issues of critical importance.

At a time of increasing growth in the Flathead Valley, and mounting pressures on the people and natural resources of the area, the Flathead Basin Commission is playing an increasingly important role as a third party in public process. Examples of activities which have been undertaken in the past two years include:

- Forest Practices Water Quality and Fisheries Cooperative Program. Completion and publication of a series of ten research reports on the impact of forest management practices on water quality.
- Creation of a working group to facilitate a zone of cooperation on the North Fork of the Flathead River, involving entities on both sides of the U.S./Canadian border, as part of recommendation formulated by the International Joint Commission.
- Complete reworking of the Flathead Basin Commission's Water Monitoring Master Plan.
- Assistance to the Governor's Office in establishing, by Executive Order, a hazardous waste advisory council to review hauling and current regulatory practices pertaining to hazardous materials and toxic wastes.
- Continuing support for the necessary planning of the Flathead Basin by county government with the support and advice of the public.
- Setting up a voluntary citizen's lake monitoring program on nineteen Basin lakes and equipping and training citizen volunteers.
- Continued education and interaction on dozens of other issues pertaining to the Flathead Basin, its continuing growth and long-term health.

On behalf of the entire Commission, our volunteers and the many citizens who regularly attend meetings or participate in the business of the Commission, I would like to thank the Governor and the Legislature for your ongoing encouragement and support. In these difficult budgetary times we hope that you will be able to continue that support, feeling as we do that this small expenditure yields results far in excess of the dollar amounts committed. With the increasingly complex issues of growth and development before us there is much work to be done. We have been a positive element to date and look forward to continuing in that role in the future.

We look forward to working with you on these complex issues and in providing working models for use throughout Montana.

Sincerely,

Gil Lusk

H. Gilbert Lusk, Chair
Flathead Basin Commission

BI-LATERAL COOPERATION AND PLANNING

LAND USE AND DEVELOPMENT TRENDS IN THE FLATHEAD BASIN

One of the main topics of conversation among residents of the Flathead is concern about development and change that is evident throughout the area. Some see it as a positive sign of the economic future. Others express anxiety about how development may effect the environment and quality of life in this special part of Montana. What follows summarizes population growth, housing, land divisions, and future development projects in the Flathead Basin and indicates trends in land use and development. The information is from Flathead and Lake counties, the two major counties that make up the Basin.

POPULATION

Flathead County has the fourth largest population in Montana. The population in Flathead County, according to the 1990 Census, was 59,218. This represents a 14% rate of growth over the last decade and was the third highest rate of growth among counties in the state. It compares to only a 1% rate of growth for the state as a whole. The county has a population density of 11.6 people per square mile, which is more than twice the density of Montana as a whole.

Lake County has the ninth largest population in the state. The count from the 1990 Census was 21,041. This represents an 11% rate of growth over the last decade and is ten times the rate of growth seen in Montana. The county has a population density of 14 people per square mile, almost three times the density elsewhere in the state.

The table in the next column summarizes Census information.

Rapid population growth, intensified land use activities and a variety of agricultural practices in the basin all contribute to concerns about maintaining high levels of water quality.

	1980 pop.	1990 pop.	Percent increase
Flathead County	51,966	59,218	14%
Lake County	19,056	21,041	11%
Montana	786,690	799,065	1%

Jerico Group, a consulting firm in Whitefish, estimates that the Census Bureau under-reported the Flathead County population by 3 percent, which is about 4,000 people. Their projection for population at year 2000 is 79,000, which is a 33% increase from 1990 and double the rate of increase of the previous decade.

Lee Nellis, a consulting planner doing work for the City of Polson, has estimated the Lake County population will be 23,915 in year 2000. This is a 14% increase from 1990 and half again the rate of increase of the previous decade.

HOUSING

The 1990 Census shows there are 26,979 housing units in Flathead County. This is an increase of 4,500 homes, which is a 20% increase in housing stock since 1980.

The Census shows there are 10,972 housing units in Lake County. This is an increase of 1,934 homes, which is a 22% increase in housing stock since 1980.

The housing stock in Montana increased by about 10 percent over the decade, which shows the Flathead Basin doubled the rate of new housing as compared to the state.

LAND DIVISION

Flathead and Lake counties have historically experienced some of the highest rate of land division in the state. Most of these land divisions have been done outside of public review through use of the 20 acre exemption, the occasional sale, and the family transfer.

The table below indicates the number of lots created in both counties in 1990 and 1991 (data from Department of Health and Environmental Sciences data). These lots were reviewed by the State Department of Health so they are less than 20 acres in size. However, most of these divisions avoided review by the local planning boards and Commissioners.

	1990	1991
Flathead County	380	439
Lake County	110	113
Montana	1,388	1,575

This data indicates that about 35% of the lots created in Montana in the last two years have been in the Flathead Basin. This trend is escalating in Flathead County; from January to August 1992 the data shows 696 lots have been created. This is an increase of 257 from 1991 with one quarter remaining in the year.

The issuance of sewer permits also shows a high increase in Flathead County; 445 permits were issued in 1990 and 603 were issued in 1991. For Lake County, 105 sewer permits were issued in 1990 and 177 were issued in 1991.

As can be seen, the trends for land divisions and land development in the Flathead Basin are increasing at rates far exceeding the rest of the state.

A multi-agency planning effort in 1993, facilitated by the River and Trail Conservation Assistance Program of the National Park Service, will work with the Flathead-area public to design a management plan for the mainstem of the Flathead River upstream from Flathead Lake. The river channel faces many problems, including large-scale bank erosion.

RECENT AND POTENTIAL DEVELOPMENT PROJECTS

In Flathead County, the Big Mountain is developing its master plan in phases. At full development, the plan will add 1,600 living units to the ski resort. Since 1990, two new golf courses have been developed and three courses have been expanded. In addition, four new courses are in the planning stages. If these are developed as planned, they will add about 1,200 living units to the area. Large scale retail and wholesale companies such as Walmart and Shopko have made inquiries about locating in the Kalispell area.

In Lake County, the Confederated Salish and Kootenai Tribes opened the KwaTaqNuk Resort in Polson in June, 1992. The resort is located on the lake and provides 112 rooms and a convention center. There are plans to expand the facility in the future. Developers are considering an expansion of the Polson Golf Course, and recently nine holes were added to the Ronan Golf Course.

A major development issue in both Flathead and lake Counties is the future of Highway 93. An Environmental Impact Statement (EIS) is being conducted on the portion between Evaro and Polson to determine the future desired route and design of this busy corridor. As part of the EIS, a Bypass Study is being done in Polson. The EIS is expected to be completed by 1994. In Flathead County, further study is being done on Highway 93 to consider alternative designs between Kalispell and Whitefish. Also, a Bypass Study on Highway 93 through Kalispell is being conducted. These efforts are also expected to be completed by 1994.

The future design and location of Highway 93 will affect land use patterns and policy in the Flathead Basin.

PLANNING EFFORTS

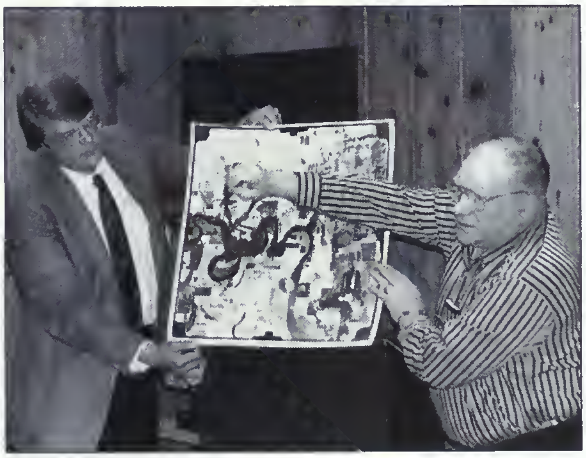
There is growing recognition and support in both counties that planning and land use regulation need to be implemented to guide growth and development. Both Flathead and Lake counties struggle with lack of resources to move quickly and respond to the increasing growth pressure that is occurring.

FLATHEAD COUNTY

The Flathead County Commissioners have adopted a policy to move toward county-wide zoning. Unfortunately, with ongoing development pressure, it is difficult for the planning staff and planning board to address future planning and land use regulations.

A coalition of public and private groups have formed the Cooperative Planning Coalition: Flathead 2020. This organization was initiated by the Flathead County Planning Board, the Flathead Building Association, the Flathead Board of Realtors, the Flathead Basin Commission, the Flathead Convention and Visitors Association, and the Big Mountain. Since its initiation, other business and conservation groups have joined the Coalition. Its purpose is to raise the necessary funds from available public and private sources to pay for professional assistance in expeditiously updating the Flathead County Master Plan and in developing land use regulations.

After circulating an RFP (Request for Proposal) to over 40 consulting firms and conducting in-person interviews with the three planning organizations chosen as finalists, the Coalition selected the firm of Design Workshop of Aspen, Colorado to undertake the project. At present the Coalition is conducting a fund-raising initiative to acquire the estimated $300,000 the project is expected to cost. Work on the Master Plan updating is scheduled for completion by the end of 1993.


Francis Van Rinsum, member of the Flathead Conservation District, discusses Flathead River erosion concerns with Commission Executive Director Rick Bartos and other members during a formal presentation before the Commission in Columbia Falls.

Another planning effort in Flathead County with significant importance to water quality will concentrate on the 40 mile mainstem of the Flathead River between the inlet on the north shore of Flathead Lake and the confluence of the South Fork and the main channel of the river near Hungry Horse. This river corridor snakes its way through the heart of the upper Flathead Valley and is surrounded by the area's most productive farmland and expanding rural population centers.

The Flathead Basin Commission, working with a coalition of federal, state and county agencies, facilitated the submission of a project proposal to the National Park Service's River and Trail Conservation Assistance program for technical assistance in designing a management plan for the corridor. While Flathead County is the agency of record for the planning project, the Commission and a number of other governmental organizations will play active roles in coordinating the planning efforts.

The Commission was informed in November of 1992 that the proposal had been accepted by the National Park Service's regional office in Denver, and that work would begin early in 1993. The program's chief for technical assistance will oversee and direct the effort, which is multi-objective in orientation and will involve a high level of public participation.

Given the complex fisheries, wildlife, recreation, agriculture and water quality issues associated with the mainstem of the Flathead River, and the increasing pressures the river will face in coming years, the advent of this planning effort is particularly timely. Thanks to interagency cooperation and the highly specialized leadership of the River and Trail Conservation Assistance Program, a long-needed planning effort will be realized with minimal expense to the residents of the Flathead Basin.

LAKE COUNTY

Lake County is moving forward in implementation of its master plan by developing area plans for parts of the county that are experiencing rapid growth or have significant resource values. In 1991, most of the East Shore of Flathead Lake was incorporated into zoning districts that established allowable uses and density restrictions. The Planning Board hopes to complete the rest of the lake in 1992-1993. Other areas the Board hopes to establish zoning for include the Highway 93 corridor, portions of the Swan Valley, and Jocko Valley, and along the Mission front.

The Confederated Salish and Kootenai Tribes are very involved in the Highway 93 EIS and have been working on a Comprehensive Lane Use Plan for the Reservation.

SUMMARY

The Flathead Basin is experiencing significant growth and development. The current pattern and trend of this growth may adversely affect the Basin's aquatic resources and other natural, cultural, physical, and social resources. At present, it is difficult for local governments to respond and plan for the future growth in the Basin due to day to day development pressures and lack of planning resources.

The Flathead Basin Commission has acknowledged that land use activities can seriously degrade water quality, and the Commission recognizes good land use planning as a means of encouraging appropriate development while maintaining the Basin's aquatic resources. The Commission will continue to work with Flathead County, Lake County, and the Confederated Salish and Kootenai Tribes to promote responsible land use planning and regulations.

NORTH FORK INITIATIVE

One of the first tasks facing the Flathead Basin Commission when it was created in 1983 was to work with the state to have the proposed Cabin Creek coal mine referred to the International Joint Commission, a bilateral organization which studies boundary issues between the United States and Canada.

In early 1985 the proposal was accepted as a reference by the International Joint Commission (IJC). A three-year study was initiated which included a Study Board and technical committees made up of U.S. and Canadian representatives. The Study Board gave its findings to the IJC in June 1988.

In December, 1988 the IJC issued its recommendations on the proposed coal mines on Cabin Creek. The IJC recommended:

1. *The mine proposal as presently defined and understood not be approved;*
2. *The mine proposal not receive regulatory approval in the future unless and until it can be demonstrated that:*
    - (a) *The potential transboundary impacts identified in the report of the Flathead River International Study Board have been determined with reasonable certainty and would constitute a level of risk acceptable to both Governments; and,*
    - (b) *The potential impacts on the sport fish populations and habitat in the Flathead River system would not occur or could be fully mitigated in an effective and assured manner; and,*
3. *The Governments consider, with the appropriate jurisdictions, opportunities for defining and implementing compatible, equitable and sustainable development activities and management strategies in the upper Flathead River basin.*

In the summer of 1991, Governor Stephens requested that the Flathead Basin Commission initiate a process to define appropriate levels of development and management strategies in the North Fork. The Flathead Basin Commission organized a Steering Committee and Core Group to begin discussions on this task. The Committee consists of the major private landowner groups in the North Fork, the major federal, state, and local government managers in the North Fork, and the major conservation and industry interests for the area. The process was facilitated by the Core Group consisting of three Commission members, and two state officials who played leadership roles in the IJC study.

The Steering Committee met nine times over the last year and conducted a public meeting in the North Fork in August, 1992. The public was invited and encouraged to participate at all meetings. A Final Strategy was completed in September, 1992 and represents a consensus of the Steering Committee.

The Final Strategy will be used by the Core Group to continue discussions with the appropriate management agencies in the U.S. and to initiate discussions with the appropriate officials in British Columbia to determine how best to implement the strategy. We tentatively plan to meet with Canadian officials in early 1993.

The complete text of the Final Strategy follows. It represents a reasonable and responsible approach for managing the North Fork of the Flathead River Basin. Governor Stephens deserves much credit for initiating this process and the Steering Committee deserves many thanks for the time and effort they put into numerous meetings and long discussions that led to the consensus.

Increasing settlement, heightened recreational use and continuing timber management activities are all issues in the North Fork of the Flathead River. A year-long Commission-directed process to identify values and management priorities on the U.S. side of the drainage will be used to formalize a management strategy with provincial officials in British Columbia.

NORTH FORK OF FLATHEAD RIVER CONCEPTUAL STRATEGY

NORTH FORK STEERING COMMITTEE — SEPTEMBER 22, 1992

MISSION

To define and implement compatible, equitable, and sustainable activities and management strategies in the upper Flathead River Basin of Montana and British Columbia.

The Mission is based on a recommendation by the International Joint Commission for the North Fork of the Flathead River Basin, (Impacts of a Proposed Coal Mine in the Flathead River Basin, December, 1988) and modified to be consistent with the British Columbia definition of sustainability (Towards a Strategy for Sustainability, British Columbia Round Table, January, 1992).

GOALS FOR NORTH FORK DRAINAGE IN MONTANA

- Preserve and if necessary restore water and air quality to sustain the environment for fish, wildlife, and people.
- Preserve and if necessary restore the ecological integrity and biodiversity of the drainage including, but not limited to the many special designations including Glacier National Park, Wild and Scenic River, International Biosphere Reserve, and the habitat necessary to sustain endangered species (gray wolf, grizzly, and bald eagle) and species of special concern such as bull trout and cutthroat trout.
- Provide for sustainable, multiple resource uses that meet the above goals.

[Above three Goals established by the North Fork Steering Committee.]

CONCEPTUAL STRATEGY FOR THE NORTH FORK DRAINAGE OF MONTANA

I. Glacier National Park

  A. Maintain and manage the North Fork drainage in Glacier as a "wilderness threshold zone" with minimal development.

  B. Limit intense recreational usage and provide for primitive recreational experiences such as hiking, boating, and non-motorized camping.

  C. Implement a limit of acceptable change program to ensure that visitor use does not alter the unique character, visitor experience, and special qualities of the park.

  D. In conjunction with U.S. Forest Service, manage floating on the wild and scenic river by; creating, designated campsites, establishing sanitation facilities, and determining limits of acceptable change for the river corridor.

  E. Give management preference to preserve and restore and gray wolf, grizzly bear, bald eagle, and peregrine falcon and other species of special concern such as bull trout and large ungulates.

  F. Purchase of private inholdings as opportunities become available.

  G. Maintain an early 1900s rustic motif of buildings.

  H. Eradicate noxious weeds.

  I. Cooperate with other management agencies and local residences to identify limits of acceptable change for the North Fork drainage.

  J. Manage and recommend designation of the North Fork drainage in Glacier Park as Wilderness.

II. U.S. Forest Service Lands

  A. Give management preference to the special designations, critical wildlife habitat, and non degradation of water and air quality over all other management practices.

  B. Give management preference to preserve and restore the habitat of the gray wolf, grizzly bear, bald eagle, peregrine falcon and other species of special concern such as bull trout and large ungulates over all other management practices.

  C. Manage and control access into existing logged areas to conform with the first two goals identified above for the North Fork drainage in Montana.

  D. Recommend congressional approval of the Mount Hefty-Tuchuck and Thompson-Seton areas, as defined in the Thompson-Seton roadless area, for Wilderness designation.

  E. Cooperate with Department of Fish, Wildlife and Parks to enhance and manage populations of resident game animals and fish.

  F. Manage the wild and scenic river stretch by establishing limits of acceptable change, and designating campsites and sanitation facilities. Buy land and/or conservation easements along wild and scenic river corridor. Develop a management plan jointly with Glacier National Park, Department of State Lands, and private landowners.

  G. Promote acquisition and enforcement of conservation easements throughout the North Fork drainage.

  H. Eradicate noxious weeds.

  I. Limit and control commercial guiding services for hunting, fishing, floating, and snowmobiling.

  J. Implement a limit of acceptable change program to ensure that visitor use does not alter the unique character of the North Fork drainage.

III. Private Land

  A. Do not expand existing phone or electrical utilities up the North Fork drainage, unless buried underground and approved by a majority of the residents.

  B. Define and preserve riparian areas and wildlife corridors.

  C. Maintain existing rustic character of dwellings.

  D. Allow cottage type industries throughout the North Fork drainage. Prohibit destination resorts, commercial guiding, heavy industry or other non-compatible commercial activity. Acceptable commercial activity should be located at Polebridge and south, and blend with the surrounding environment and severely restrict visual, auditory, and olfactory impacts.

E. Maintain low population density by encouraging cluster development as a method of protecting "open spaces" and wildlife habitat. Discourage subdividing and summer home developments. Develop a program that promotes the creation of conservation easements and land trusts that maintains low population density.

F. Develop zoning and regulations to encourage compatible development and usage on private lands that protects the special designations, critical wildlife habitat, water and air quality, endangered species and species of special concern.

G. Enforce non degradation standards for sewage systems.

H. Develop no more public access sites to the North Fork River from the west side of the river. Keep the private land bordering the river free from additional improvements which would be visible from the river.

I. Develop an education program for property owners regarding living in the North Fork that is compatible with its special qualities.

J. Implement a limit of acceptable change program to ensure resident and visitor use does not alter the unique character of the North Fork.

K. Eradicate noxious weeds.

IV. North Fork Road

A. Maintain the existing condition of the road. However, do mitigate and control those stretches of the North Fork road where sediment and dust enters into the North Fork River or its tributaries. Explore alternative means other than paving the road to control dust for safety and health purposes.

B. Explore ways of limiting usage of the road such as limiting destination sites such as new or expanded campgrounds in the North Fork. A part of this task would be to conduct a traffic study on origin and destination of vehicle usage. Also, evaluate whether creating a scenic route along the Camas Creek Road in Glacier and then southward on the North Fork Road where it intersects with the Camas Creek Road would curb traffic from going north into the basin.

C. Eradicate noxious weeds along roads.

D. Develop turnouts where necessary to enhance traffic safety.

V. Department of State Lands

A. Encourage the Department of State Lands through the State Board of Land Commissioners and U.S. Forest Service to conduct land exchanges where State Lands would exchange its North Fork land to the Forest Service for comparable Forest Service land elsewhere.

B. Manage the forest to produce a reasonable and legitimate income for the state trust funds while giving management preference to the special designations, critical wildlife habitat, and non degradation of water and air quality over all other management practices.

C. Manage the forest to produce a reasonable and legitimate income for the state trust funds while giving management preference to preserve and restore the gray wolf, grizzly bear, bald eagle, peregrine falcon and other species of special concern such as bull trout and large ungulates over all other management practices.

D. Manage and control access into existing logged areas to conform with the first two goals identified above for the North Fork drainage in Montana.

E. Cooperate with Department of Fish, Wildlife and Parks to enhance and manage populations of resident game animals and fish.

F. Eradicate noxious weeds.

G. Cooperate in a limit of acceptable change program to ensure visitor use does not alter the unique character of the North Fork.

VI. Mineral Leasing, Exploration, and Development

A. Mineral leasing, exploration, and development on all lands in the North Fork drainage must be subject to the same management considerations, goals, standards, and objectives as the other resources identified in this document which include stringent public and environmental review.

B. Mineral exploration and development on all lands must not adversely affect the many special designations in the North Fork drainage, and critical wildlife habitat, nor cause the degradation of water and air quality.

BI-NATIONAL CONSERVATION STRATEGY

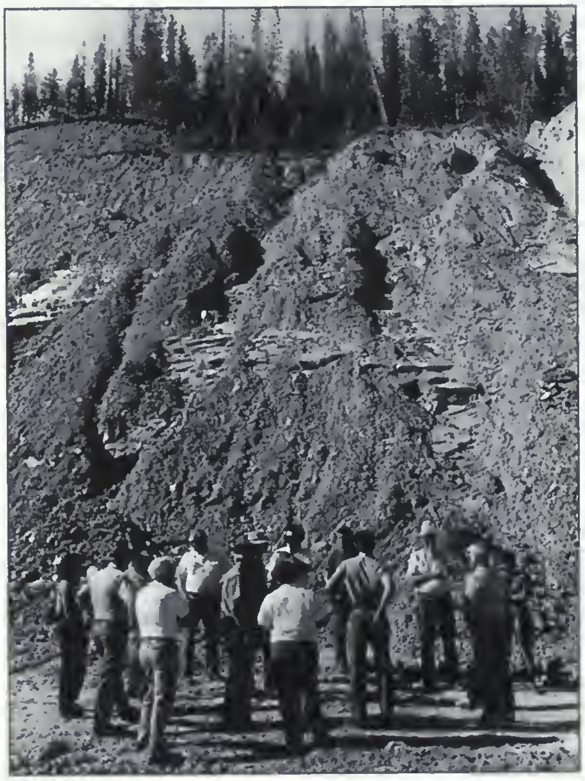
To begin discussions with British Columbia, the Core Negotiating Team and a comparable B.C. entity should consider the following:

I. Establish a Joint Board with equal representation from British Columbia and Montana to achieve compliance on the goals and objectives of the Bi-national Conservation Strategy.

II. Establish a new common trust fund to manage and implement the bi-national management plan.

III. Components of the bi-national management plan might include:

A. Ensure compliance with the three goals defined for the North Fork drainage in Montana.



Commission members and other state, local and federal officials plan anti-erosion measures on the North Fork of the Flathead River.

B. Manage the basin with special emphasis on the eagle, grizzly bear, gray wolf, bull trout, and other species of concern.

C. Develop and administer a benign research program that focuses on: monitoring baseline conditions, developing environmentally compatible resource utilization methods, preserving animal and plant species of special concern, restoring new and already disturbed areas, and defining appropriate types and levels of development.

D. Develop a strategy for research that limits handling of fish and wildlife and provide for a stringent review process to ensure elimination of unnecessary research projects.

E. To encourage bi-national symmetry, the Province of British Columbia and the Canadian Federal governments and Canadian public will be invited to participate in all United States and Montana environmental review processes on actions affecting the North Fork drainage.

F. Such other issues that are of interest to the people and government of British Columbia.

IV. Other details of the bi-national program, including the management structure and financing would probably be defined through this formal process. Input would be directly sought from the North Fork Steering Committee and the Flathead Basin Commission between negotiation sessions.

HAZARDOUS MATERIALS

BACKGROUND

The Hazardous Materials Committee was organized as part of the Flathead Basin Commission to coordinate and educate the basin area on the hazardous materials concerns and issues. The committee members have an organized tie into the Local Emergency Planning Committees (LEPCs) to each of the counties and tribal governments of the Flathead Basin. The LEPCs are part of the planning structure of the county and tribal Disaster and Emergency Service Offices.

The committee membership is: Rick Bartos, Flathead Basin Commission Executive Director, Office of the Governor; Dennis Christenson, Committee Chairperson, U.S. Bureau of Reclamation; Bill Engle, Environmental Protection Agency Representative; John Lozeau, Confederated Salish and Kootenai Tribes Representative; Robert O'Leary, Montana Power Company Representative; Sharon Stratton, Flathead County Commissioner; Rose Schwennesen, Citizen Representative.

Ad Hoc advisory group members include: Kim Potter, Flathead County DES Director; Lloyd Jackson, Tribal Disaster Preparedness Office; Dick Giffin, Lake County DES Director; Curt Laingen, Montana Motor Carriers Association; Dave Gault, Montana Department of Transportation.

Dennis Christenson was selected by the Flathead Basin Commission to be the representative on the Governor's Task Force on Hazardous Materials. The concerns to be taken to the Task Force meeting from the Flathead Basin Commission are:

- Transportation routing of hazardous materials taking into account protection of human life and the environment.
- Class A Responder qualification, training, and costs to maintain certification.
- The problem of one state agency having the responsibility for tracking the shipping of hazardous materials and enforcement.
- Department of Health and Environmental Sciences (DHES) should become pro-active in response to hazardous materials incidents.
- Apply Federal Regulations to regulate the routing of hazardous materials.
- To effect a pro-active response to hazardous materials spills on a state wide basis tieing in all government agencies and industry for emergency response.

PUBLIC INVOLVEMENT

The main thrust of the Flathead Basin Commission is public involvement and education. The Hazardous Materials Committee is developing a plan to involve the public in the hazardous materials issues to bring out cross-section diversity and creative solution processes. The issues of concern are:

- Public use of sprays that could affect water quality.
- Industrial compliance with SARA Title III.
- Notification of hazardous materials problems.
- Recycling programs.
- Home owner chemical disposal.
- Recreation boating issues such as gray water discharge and hydro carbon discharges.
- Transportation of hazardous materials through the Flathead Basin.
- Hazardous material spill response.
- Coordination of spill control response and clean up efforts.
- Training of emergency response and law enforcement personnel.

- Training of transportation operators and weigh station employees. Awareness and mock emergencies.
- Enforcement procedures.

The public education program is being proposed to include:

- School programs.
- Training seminars targeting specific audiences.
- Sportsman/fishing/floating/environmental groups.
- Press releases — general media/transportation and industrial periodicals/County Extension articles.
- Spill reporting procedures.
- PUD publications.

TRANSPORTATION ISSUES

Since the Whitefish Lake oil spill of 1989, all county and tribal agencies have increased their awareness, training, and cleanup materials stockpile. The railroad industry has actively participated in committee efforts, and has helped provide supplies, and is a willing member of a cooperative effort to be ready should another spill occur. Improvements in track design and maintenance, and car maintenance programs are being implemented, as well as speed reduction in critical areas.

The trucking industry needs to be thoroughly reviewed in the Flathead Basin as to routing, highway construction for pollution protection (Federal funds may be available), driver education and certification, trailer construction standards, tracking of hazardous materials, intermediate storage and dock procedures, law enforcement coordination, notification of spill procedures, and weigh station personnel training.

Law enforcement personnel training and proper reporting and recognition is training considered to be critical to activate the containment and cleanup system as soon as possible.

SPILL RESPONSE

The Flathead Basin Commission initiated a River Study in which potential boom sites were selected and documented for the Flathead River. The study has been transferred to the Flathead County Local Emergency Planning Committee to be finished and include smaller tributary rivers in high potential spill areas. Similar work needs to be done for the Lake County area.

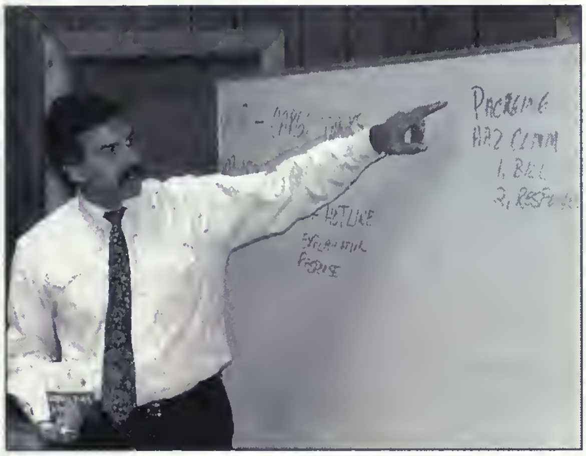
The Flathead County Local Emergency Planning Committee is also to continue an effort to bring together a Memorandum of Understanding (MOU) of Mutual Response Agreements. The MOU is to cover state, federal, and tribal agencies and applicable industrial entities. The listed items will be addressed in the agreement:

- Expertise available
- Available equipment
- Training plan
- Media assistance/communications
- Funding and reimbursement policies

The Counties and Tribes within the Basin coordinated together and purchased a large supply of oil spill clean up materials at a 50% cost reduction. Burlington Northern has given the booms used in the 1989 spill to Flathead County. Plans call for distribution of the spill containment materials to key locations around the Basin to aid in rapid response. Community Quick Response Units are being trained in deployment of booms and "mock emergency" drills are being planned.

The Commission recommends that the planning being done for the Flathead Basin be extended across the State of Montana.

A gasoline spill occurred on 9/16/92 at 1400 hours at Yellow Bay on Flathead Lake. About 2,661 gallons were lost in the spill and about 300 gallons ran into the lake. The spill occurred when a trailer hitch of a semi-truck trailer broke as a result of metal fatigue.



The Commission's growing concern about the threats to water quality posed by the shipment of hazardous materials through the basin has resulted in increased efforts to formulate strategies to minimize potential impacts. Here, Curt Laingen, Safety Officer with the Montana Motor Carriers Association, briefs the Commission on steps the industry is taking to reduce such risks.

The tanker trailer ended up upside down in the ditch along Montana Highway 35. The truck was carrying 7,500 gallons of gasoline. A stream next to the road picked up some of the spilled gasoline and a carried it into a culvert under the road and into the lake. Wind blew the gasoline in the lake toward the shore, helping containment efforts.

Firefighters quickly dammed the culvert and took action to prevent a fire from starting. The Salish-Kootenai Tribal shoreline protection officials placed a boom along the lakeshore to intercept gasoline reaching the lake. Olympus Environmental Inc. was at the site Wednesday night removing contaminated soil.

Lloyd Jackson of the Tribal Shoreline Protection Office praised everyone who responded to the accident and spill. The Yellow Bay Fire Department, the Shoreline Protection Office staff, the Highway Maintenance Department, the Tribal Police, the Lake County Disaster Office, and personnel from Mission Valley Power provided proper and rapid response. Within an hour of the accident, the crew had a boom across the spill area in the lake, and had the area covered with absorbent materials. The cleanup contractor was on site within three hours of the spill.

A monitoring well was drilled at the site, downslope from the spill area to monitor groundwater.

The rapid response with proper materials was the result of a joint bulk purchase of absorbent materials and training initiated by the Flathead County Department of Emergency Services as a result of lessons learned from the Whitefish Lake oil spill that occurred in July 1989. The Flathead Basin Commission was involved in the aftermath public process and the Flathead County Local Emergency Planning Committee to facilitate a basin spill response plan.

The Flathead Basin Commission will facilitate the public process in reviewing the hazardous materials haul routes which would have high risk potential to Flathead Lake. The Montana Department of Transportation is hiring a consultant to study truck traffic along both sides of the lake. The study is expected to be completed in six months and provide information as a framework for debate on long-term solutions.

SOLID WASTE

There are numerous landfill sites around the Flathead Basin that are in the process of "Site Assessment" under EPA regulations. This program is of interest to the Commission due to possible groundwater effects which may cause surface water quality problems.

Disposal regulations have been greatly improved in the last several years and old landfill sites could contain hazardous materials that should be screened and, if needed, be monitored. County Planning Offices should develop standards that are satisfied prior to allowing housing developments and wells to be drilled near old landfill sites.

Recycling needs to be emphasized to encourage industrial conservation, reduce disposal pollution, and keep hazardous materials from becoming non-point source problems to ground and surface water quality.

Pump out stations are needed on Flathead Lake for boating, gray water and sewage disposal, and present regulations enforced.

Home owner and small ranch chemical disposal needs to also be addressed to reduce and eliminate numerous potential problems.

HAZARDOUS MATERIALS SITE CLEAN-UP

Several Flathead County industrial sites with documented high levels of hazardous contaminants continued to receive various levels of review, analyses and clean-up during the past two years.

In Evergreen, an unincorporated bedroom community on Kalispell's eastern boundary, three adjacent sites have been under ongoing investigation and supervision by both the Montana Department of Health and Environmental Science's Superfund program and the U.S. Environmental protection Agency's Helena-based Remedial program.

The clean-up of hazardous waste sites in the Flathead Valley intensified in the biennium. This location, in Evergreen near Kalispell, is of particular concern because of the high water table in the area.

Two of the sites are former oil refineries — the Reliance Oil Company and the Yale Oil Refinery. Neither site has seen commercial operation since the 1950s, but substantial amounts of Pentachlorophenol and other compounds of a petroleum and hydrocarbon base are present. Exxon, the current owner of the Yale Oil Refinery property, is undergoing a voluntary program to remove contaminated sludge and to prepare for on-site incineration of contaminated soils in 1993.

The neighboring Reliance Oil Company property and Kalispell Pole and Timber Company operation pose a greater potential risk to water quality. Adjacent to the Stillwater River and in the proximity of residential areas and functioning commercial operations, the two sites contain a variety of specific problems, including the presence of Penta, petroleum-based solvents and other petroleum products present in soil and lagoons.

Montana Department of Health and Environmental Sciences conducts routine sampling of approximately one dozen residential wells in the immediate area. While the monitoring has found no contamination of drinking water from the well sites, testing has revealed severe contamination of groundwater at the site, with particularly high concentrations of Penta. There is disagreement over whether the contaminated groundwater can penetrate to the deeper aquifer.

Meanwhile, extensive ongoing testing has been done at the Kalispell Pole and Timber and Reliance Oil Company combined site to determine whether it will qualify for listing on the EPA's Hazardous Superfund designation for national priority classification.

It is the consensus of state and federal officials who have been involved in study of the site that it should qualify for Superfund designation and is anticipated to gain such designation in 1993. That will allow for a full-scale clean-up to be initiated.

In Somers, on the north shore of Flathead Lake, the EPA is overseeing an expansion of efforts to clean-up hazardous materials associated with the operation of a railroad tie treatment plant for most of this century. The proximity to Flathead Lake has raised concerns about water quality in the area, while a direct health risk to the local population of several hundred people has also been a concern.

Both soil and groundwater at the site have been extensively contaminated with creosote, an oily liquid distilled from coal tar used to preserve wood. In 1985, 3,000 cubic yards of highly contaminated soil were removed from the site. In 1993, the EPA will begin supervision of a long-term project to treat an estimated 40,000 cubic yards of soil at the site and begin a groundwater treatment process that might take as long as 50 years to successfully complete.

Contractors have constructed a 13 acre land treatment area where soil will be exposed to intensive agricultural methods in an effort to reduce the presence of contaminants. Through a program of ploughing and sprinkling, naturally present bacteria in the soil that will act to break down carbons in the toxic chemical will be activated. Contaminated soils will be taken from three locations, including an area adjacent to Flathead Lake.

The groundwater treatment program will involve pumping and treating water with carbon before introducing it back into the aquifer. Officials consider the groundwater problem particularly serious and difficult to mitigate.

The Somers site was proposed for listing with the Superfund program in 1985 but has never been given national priority status. However, both state and federal officials say the site has received attention as though it had been given such status and that work now underway to resolve the contamination problem is consistent with efforts that are directed at clean-up projects at Superfund sites.

COLUMBIA FALLS ALUMINUM PLANT CYANIDE DISCHARGE

The seepage of cyanide from property owned by the Columbia Falls Aluminum Plant into the Flathead River received heightened attention in 1992. The situation was discovered in 1991 when a seep near the river was found to contain concentrations of both cyanide and fluoride.

The source of the pollution is a nearby quantity of contaminated material buried on Columbia Falls Aluminum Company (CFAC) property during the 1950s, '60s and '70s Officials estimate that up to 100,000 tons of materials, the by-products of the pot line operations, were buried on-site before CFAC contracted to have such materials hauled from the plant to a licensed hazardous materials disposal site.

Groundwater, mostly runoff from the nearby Teakettle Mountain, flushes through the contaminated material and carries it to the bank of the Flathead River where seepage occurs along a 200 to 300 yard length of river bank. The most recent tests indicate that the presence of cyanide in the seepage equals 0.1 part per million. Company officials believe that is an insignificant amount that poses no health danger, and say it is only half of the level of cyanide allowed by law in drinking water.

However, the discharge is in violation of the Montana Water Quality Act's non-degradation clause, which led CFAC to attempt a number of mitigation measures during 1992. The efforts, unfortunately, were unsuccessful. The company attempted to drill a number of wells that would have been used to pump water from the aquifer and intercept it before it reached the river. Given the sandy soils present at the site and the overall expense of drilling the wells and continuously operating them, the plan was considered by the company to be economically unfeasible.

Company officials site the huge dilution factor present to downplay fears of injurious contamination. The average river flow at the site is 50,000 cubic feet per second. The seepage contributes up to 200 gallons a minute at the seasonal peak. CFAC

The mainstem of the Flathead River near Bigfork.

does maintain an on-site well monitoring program, which has documented a steady decline in the amount of fluoride since the monitoring began in 1981. In that year, 7.7 parts per million of fluoride were counted. In 1991, the fluoride level had decreased to 2.2 parts per million. Readings on cyanide, however, have not been found to be in retreat as rapidly.

CFAC currently has a groundwater permit and plans to petition the State Board of Health to obtain a variance, believing the environmental impact is insignificant and that steps to completely eliminate the presence of cyanide and fluoride are cost prohibitive and unnecessary.

Under the state's non-degradation clause, the introduction of chemicals into a body of water at levels greater than the substance naturally occurring is illegal. If prosecuted and found guilty of the infraction, CFAC could be fined up to $10,000 a day. The fine could be up to $25,000 a day if prosecuted and found guilty under criminal statutes.

These projects will be monitored by the Flathead Basin Commission for proper resolution.

The effectiveness of the Commission has been enhanced by the creation of a more streamlined committee structure. Members Dennis McDonald, the liaison from British Columbia, and John Lozeau, the Confederated Salish and Kootenai Tribes representative, listen as Chair Gil Lusk outlines committee duties.

Water quality problems confronting the basin are many. Here, Lake County Bridge Department workers remove the carcass of a dead cow from Flathead Lake near Woods Bay.

EDUCATION, INFORMATION AND RECOGNITION

PUBLIC INFORMATION

One of the Commission's most rewarding day-to-day responsibilities is working with area media and a diverse group of public and private entities to advance the understanding of water quality issues in the basin.

The level of respect the Commission maintains and the high visibility it enjoys in the community is evident in the regular, positive coverage its activities receive. Through the ongoing interest of a variety of print and electronic media in western Montana, the public gains important insights into the Commission's work and becomes better informed about the issues with which it is involved. Regular coverage includes Montana Public Radio, commercial television and radio stations, local cable access television, and a number of daily and weekly newspapers.

To assist in furthering the public's understanding of water quality concerns in the basin, the Commission makes a variety of presentations, publications and video documentaries available to interested organizations. In addition, the Commission is frequently called upon to deliver expert testimony to government agencies and boards regarding its stated positions on water quality issue.

The Commission also works closely with educational institutions and advisory groups to insure that students can gain accurate, localized information on aquatic systems and related issues. Outside of the Flathead Basin, the Commission is active on several state-wide advisory committees, including the Montana State University-based Water Resources Center and The Montana Watercourse. Within the basin, the Commission actively participates with such organizations as the Flathead County Groundwater Coordination Committee, the Cooperative Planning Coalition, and the Voluntary Dispute Resolution Steering Committee of the Glacier Institute.

The following lists public presentations made in the biennium.

SCHOOLS

- Flathead High School*
- Columbia Falls High School*
- District 6 Alternative High School
- Kalispell Junior High School*
- Somers Elementary School
- Deer Park Elementary School
- Hedges Elementary School
- Project WILD In-service Training*
- Flathead Co. rural schools science teachers

GOVERNMENTAL/AGENCIES

- Confederated Salish and Kootenai Tribal Council
- Bonneville Power Administration
- Kalispell Area Chamber of Commerce
- Kalispell City-County Planning Board
- Environmental Quality Council
- Kalispell City Council
- Flathead Conservation District
- Northwest Power Planning Council
- Montana Legislature

SERVICE ORGANIZATIONS/CLUBS/OTHER GROUPS

- Whitefish Lake Boat Club*
- Flathead Lakers
- Family Forestry Expo*
- Hoo Hoo Club (Timber Industry professional group)
- East Valley Grange
- Evergreen Lions Club
- Columbia Falls Kiwanis Club
- Kalispell Kiwanis Club
- Glacier Kiwanis Club
- Whitefish Rotary Club
- Lions Club youth camp
- Flathead Audubon Society
- LaSalle Grange
- Society of American Foresters*
- Earth Day observance*
- Flathead 4-H Club
- LARIX International Conference
- National Conference on Enhancing the States' Lake Management Programs
- Pilot Club (professional women's group)
- Sunrisers Lions Club
- Northwest Montana Environmental Educators CORE Group*
- Montana Native Plant Society
- Flathead Resource Roundtable
- Stillwater Grange
- Flathead Paddlers Club
- Kalispell Downtowners Lions Club*
- The Friendship Force
- Flathead Co. Solid Waste Task Force

* Indicates more than one presentation to the same organization

Note: Estimated audience reached through class and small group presentations: 1,100. Estimated audience reached through participation in Family Forestry Expo and Earth Day activities: 3,000

PUBLIC LAND LAW REVIEW SEMINAR

In 1992, the Flathead Basin Commission had a unique opportunity to being basin-wide management issues to the fore in a high profile setting outside of the basin. Working with the University of Montana Law School's Public Land Law Review and the Native American Law Students Association, the Commission helped design and conduct a full day seminar in Missoula.

Presented for the legal profession and interested lay people, the program raised resource management concerns, presented the views of competing interests, and proposed alternative ways of resolving competing resource demands. Titled *The Flathead Basin Commission: Building a Consensus for Resource Management*, the seminar focused on issues relating to the presence of several overlapping federal, state, local and tribal jurisdictions within one well defined geographic area.

The seminar showcased the Commission's method of coordinating and resolving natural resource issues in a rapidly growing, multi-jurisdictional region. Speakers drawn from agency, tribal, academic and public groups addressed a wide range of issues confronting the Commission has proven to be an effective tool in resolving conflicts in the basin.

> *"There are institutional gaps. Environmental responsibility is separate from economic responsibility. . . Change* will *happen; process should change too. In the midst of new values there is failing infrastructure. . . The problems can be solved, but some personalities cannot be solved."*

H. Gilbert Lusk, Superintendent
Glacier National Park
Commission Chair

> *"Water is life. Flathead Lake is a living presence that shapes the life styles, landscape, and economy of our region. It serves as a mirror that reflects on how well we are living in balance with our environment. It reflects our value judgments."*

Dick Wollin, President
Flathead Lakers, Inc.

> *"The significant reality is the relationship. . . We assume that the environmental services of self-renewal and replenishment provided us by those natural systems that yet retain their functional integrity are immune from the ill-considered impacts that we inflict. . . We are familiar with the products of ecosystems. . . unaware of the processes that shaped their unique character and sustain their production."*

George Darrow, first Chair
Environmental Quality Council

> *"If you have data, you have less controversy, always."*

Dr. Jack Stanford, Director
University of Montana
Biological Station

> *"The Flathead Basin Commission is an environmental, ecological, non-political brain trust."*

Rick Bartos, Executive Director
Flathead Basin Commission

> *"Sustainability is forever."*

Joel Holtrop, Supervisor
Flathead National Forest,
Flathead Basin Commission

> *"How we view the land is a values debate. The legislative, executive, judicial arenas of policy are about being involved in changing things ecosystematically."*

Dr. Robert Keiter,
University of Wyoming
School of Law

> *"The tribal/state hunting and fishing cooperative agreement works well as an ecological bio-regional compact. The Flathead Basin Commission has excellent communications on the issues concerning the tribal aboriginal homeland (Flathead Basin)."*

Pat Smith, Attorney
Confederated Salish & Kootenai
Tribes

"There should be more commissions in river basins in Montana to make a healthy environmental and economy possible. Montana's public policy is environmental protection — a safe, healthful, productive environment. Informal dispute resolution is best when conflict exists."

Jean Turnage, Chief Justice
Montana Supreme Court and
sponsor of legislation that
created the Commission in 1983

SUMMARY

The cooperative process involved in conceptualizing and presenting the seminar served to create a new model for Commission public involvement. The Commission may conduct future such seminars in cooperation with the University of Montana Law School and other organizations outside of the basin. At the same time, the seminar underscored the importance of the Commission as an effective, non-traditional structure for managing inter-agency disputes and allowing the public a purposeful way of seeking solutions to their natural resource-related concerns.

Richard Wollin, President of the Flathead Lakers and a tireless advocate for the basin's aquatic resources, was named recipient of the Commission's first annual Stewardship Award. Elna Darrow, Chair of the Education and Public Information Committee, presents the award, which will be given annually to a basin resident whose work as a private citizen has done the most to address water quality concerns.

MONITORING

FORESTRY PRACTICES COOPERATIVE PROGRAM

In its role as a facilitator, the Flathead Basin Commission helped design, initiate and coordinate a landmark, basin-wide study of forestry practices and their effect on water quality and fisheries. The two year, $223,000 effort began in mid-1988 when the basin's primary forest land managers — the Flathead National Forest, the Montana Department of State Lands, and Plum Creek Timber Company — signed a Memorandum of Understanding agreeing to fund the ten part series of scientific studies and take recommendations produced by the studies into consideration when designing future land management strategies and monitoring programs.

The studies were meant to focus the timber harvest/water quality debate on facts rather than emotion.

The culmination of the cooperative program was a public forum conducted on July 16, 1991, hosted by the Commission. The forum included a summary discussion of the ten scientific studies, a series of recommendations from the study leaders to the land managers, and the public release of the Final Report for the Cooperative Program. The Final Report included the study reports, study conclusions, the consensus recommendations of the study leaders, and the land managers' response to the recommendations.

Since the formal release of the Final Report, a number of recommendations made to the land managers have been implemented in one form or another within the basin. The following is a brief discussion of some of those efforts.

The Commission-coordinated two-year study of forestry practices in the basin culminated in a seminar in Kalispell to present the conclusions and recommendations of the 10 scientific studies. Chair Gil Lusk addresses the gathering, which included land managers, scientists and forestry professionals from throughout the region.

FOREST PRACTICE AND WATERSHED EVALUATION

There is commitment by all land management organizations to strictly implement the Best Management Practices for Forestry in Montana (BMPs) as adopted by the Environmental Quality Council. The cooperative studies acted as a catalyst to bring about a uniform understanding of the BMPs by personnel from the agencies, industry, and special interest groups.

In the past year, all three land management organizations have initiated an internal BMP audit procedure to review timber sale projects on their lands. The first benefit of a BMP audit procedure is education, both internally in the organization and externally with interested publics. The second benefit is a documented annual evaluation of the success in BMP application and effectiveness of the BMPs that were applied.

Much of the information concerning streamside management zones (SMZs) developed during the cooperative studies is being used by the land management organizations in field identification of SMZs during project planning.

As partners in the Montana Cumulative Effects Cooperative, the three land management organizations aided in the development of a predictive watershed computer model (WATSED). This model was first tested in the basin during the cooperative studies. The initial calibration work started during the cooperative studies has continued. This computer model is currently being used to predict possible water quality effects on many proposed timber sale projects in the Flathead Basin.

Timber harvesting continues to be one of the basin's most important industries. A scientific study coordinated by the Commission has resulted in improved forestry practices and identified management techniques that will help protect water quality.

Water Quality and Fisheries

The information gained in the fisheries studies may be the most significant result of the cooperative studies. For the first time, some of the habitat requirements for Bull Trout and Westslope Cutthroat Trout have been quantified. The Final Report discussed several recommendations that dealt with maintaining and improving water quality primarily for the protection of fisheries habitat. These recommendations have caused increased levels of activity in three program areas for the land management organizations.

First, dollars and personnel are being utilized to identify and rehabilitate existing sources of sediment, both natural and human-caused.

Second, during the planning stages of proposed timber harvest and new road development, a detailed analysis using on-site information and/or computer modeling is done to insure the project is within the recommended sediment control parameters for protection of fisheries habitat.

Third, the land management organizations, in cooperation with the Department of Fish, Wildlife and Parks, have identified additional fisheries streams for the fisheries habitat monitoring program.

Monitoring and Additional Study Needs

The Cooperative Program Final Report contains a number of recommendations for additional studies. These recommendations need to be evaluated for incorporation into the update of the Flathead Basin Commission's Monitoring Master Plan for the Flathead River Basin. The process of updating the monitoring plan began in the fall of 1992.

Among the specific recommendations are:

- The acceptance and use of the state's Best Management Practices is the first step toward ensuring that forest practices will not degrade water quality and fisheries.
- Because of the demonstrated value of the audit BMP process, it is recommended that audits continue on an annual or biannual basis.
- Land managers should utilize the new riparian habitat type classification and type-specific management information for guidance in site-specific prescriptions.
- Land managers should also adopt the new streamside management zone criteria set by the Montana Riparian Association.
- Further study is needed to improve watershed prediction models so that they become more reliable for assessing probably cumulative effects of a range of practices for a range of site conditions.
- Watershed level analysis and planning to address cumulative effects and scheduling of activities should be standard practice. Cooperative planning and coordination of activities should become a standard practice in all mixed-ownership drainages.

On the critical subject of fisheries, the study recommended that a stream should be considered threatened when the percentage of fine materials in spawning gravels in any given year is greater than 35%, and when the substrate score — or the measure of imbeddedness — is less than 10 for bull trout streams, the stream is given the threatened designation.

If any disturbance activity is planned in such a watershed, the land owner should take active precautions to minimize new sediment loading to the stream and lake steps to ameliorate past roading or other human land disturbances that continue to contribute sediments to streams. The study also established criterion for identifying a stream as being "impaired."

In the area of monitoring, the study recommended that the Flathead Basin Commission Monitoring Master Plan be adjusted to reflect the evaluation of cause-and-effect relationships between forest practices such as BMPs and selected water quality variables, fish populations and fish habitat.

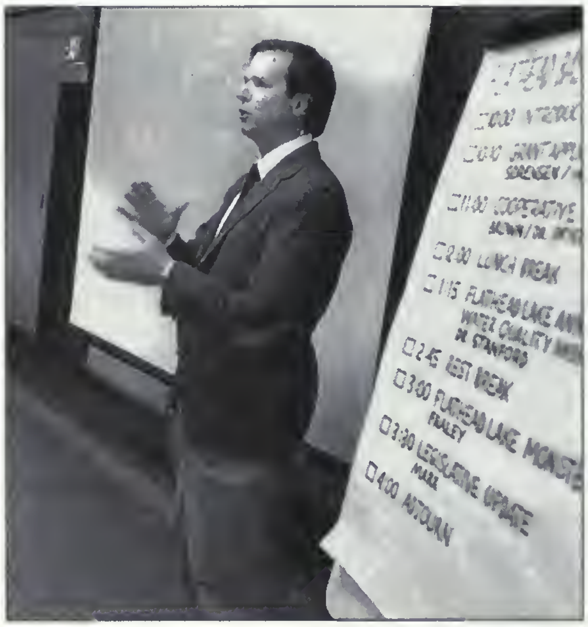
The Flathead Basin's major land managers responded to the conclusions and recommendations, saying, "We recognize the importance of maintaining water quality and fisheries and will continue to give these valuable resources the attention they deserve." They also noted that they "recognize that the implementation of effective Best Management Practices is required to ensure that the effects of forest practices are minimized."

"In recent years," the managers stated, "more attention has been focused on eliminating or controlling sediment delivery to streams from management activities. Efforts should continue to improve forest practices to reduce erosion and transport of sediment and nutrients to surface waters. We will emphasize this objective as a crucial step in the protection of water quality and fish habitat."

The managers concluded their response by observing, "We accept our responsibility to ensure that forest practices do not degrade fish habitat. Water quality and fisheries habitat monitoring are high priority programs. These studies were invaluable in providing a focus on the relationships between forest practices, water quality, and fisheries."

SUMMARY

The Cooperative Program has increased understanding of our natural resources and has improved the quality of resource management in the Flathead Basin. Most of the recommendations from the Final Report are being implemented. Because of the extraordinary place the Flathead Basin is, extraordinary efforts in quality management of our natural resources are justified.



Dr. Jack Stanford, director of the University of Montana Biological Station at Yellow Bay, briefs the Commission on the basin's water quality. Among recent trends identified by Stanford's scientific research team is evidence of oxygen depletion in both Swan and Flathead lakes.

VOLUNTEER MONITORING PROGRAM

In the summer of 1992, the Commission initiated a citizen-driven program to conduct water quality monitoring activities on lakes in the Flathead Basin. The project is modeled after successful, long-running programs elsewhere in the U.S. that have involved citizen volunteers to carry out routine monitoring procedures.

The project is the first of its kind in Montana and thus will serve as a model for other programs that are likely to be created in coming years elsewhere in the state. The project was designed to meet the standards set by the Environmental Protection Agency's Clean Lakes program, which is the national administrative focal point for virtually all of the country's volunteer monitoring programs. Within the state, the project is being coordinated with the Montana Department of Health and Environmental Sciences Water Quality Bureau and the University of Montana Biological Station at Yellow Bay.

Initial funding to help activate the project through the purchase of start-up monitoring equipment was made available by the Coors Brewery Pure Water 2000 Program. The efforts of the local Coors distributor, Fun Beverage of Kalispell, were successful in obtaining $2,100 to facilitate the purchase of 21 monitoring kits, several additional equipment components, and reporting forms.

In December of 1992, additional funding through an EPA 70-30 matching grant was obtained for use in the Montana fiscal years 1993-94. The two year EPA allocation of approximately $16,000 will allow for the summer employment of an intern coordinator for the program, additional equipment to meet the needs of increasing numbers of volunteers, data collection and processing, analyses of annual samples taken for *chlorophyll a* and *total phosphorus*, volunteer training, and travel for participation in national and regional conferences and training seminars. The receipt of the EPA funds, facilitated by the Montana Department of Health and Environmental Sciences Water Quality Bureau, will serve to strengthen and expand the monitoring project.

The Commission's recently initiated Volunteer Monitoring Program is the first of its kind in Montana. Here, Dr. Rick Hauer of the University of Montana Biological Station conducts a training session for new participants in the effort.

In the start-up phase, the Volunteer Monitoring Project recruited approximately 80 citizens and trained half of that number at an August, 1992 workshop at the University of Montana Biological Station. Monitoring activities — which include biweekly turbidity readings, water temperature and a number of meteorological and water-related observations — are now being conducted at approximately 25 monitoring sites on over a dozen lakes in the Flathead Basin. Given the ongoing public interest in the project and realistic possibility of doubling the number of monitoring sites, the project is anticipated to grow to include the active participation of well over 100 citizen volunteers.

SUMMARY

The monitoring activities fill a large void in the collection of scientifically valid data on Flathead Basin water. Given funding cutbacks, such agencies as Montana Department of Natural Resources and Conservation and the Biological Station have had to either reduce their level of monitoring or curtail future expansion plans. The Volunteer Monitoring Project allows the scientific community and a variety of local, state, federal and tribal agencies to benefit from the routine collection of essential base-line data through the volunteer program. At the same time, the project has activated the personal involvement of citizens, from high school students to the retired, in a process that should produce substantial benefits in the areas of public education and stewardship.

FISHERIES MITIGATION PROGRAMS

The thermal effects of discharges from Hungry Horse Dam on downstream fisheries remains a major concern to the Flathead Basin Commission and a variety of agencies that manage fisheries in the basin.

The dam currently has only one stationary outlet at a depth of 75 meters below the dam's crest. Frigid water from the bottom of the reservoir discharged from this depth remains about 4° C (40° F) during all months of the year. Cold water releases slow fish growth and affect insect production.

Temperature recorders maintained by the Montana Department of Fish, Wildlife and Parks have shown fluctuating discharges from the dam under current operation practices cause temperature fluctuations of up to 14° F in the Flathead River below the South Fork confluence. This occurs when cold pulses from the dam mix with warm summer temperatures in the river downstream. A rapid 4° F temperature change has been shown to be damaging to aquatic organisms.

Montana Governor Stan Stephens congratulates students from the Flathead High School advanced biology class of Mrs. Linda DeKort for their involvement in giving testimony on Fisheries Mitigation to the Northwest Power Planning Council.

Thermal effects are detectable for over 40 miles downstream to Flathead Lake. The moderating effects of natural temperature water inflowing from the Stillwater River does not totally eliminate thermal fluctuations caused by Hungry Horse Dam. Although temperature changes are less rapid (hours rather than minutes) in the lower half of the affected river reach, fluctuations are detectable at Holt Bridge near Bigfork on the north shore of Flathead Lake. The best rearing habitat for fish species of special concern exists in the highly affected portion of the Flathead River upstream from the Stillwater River confluence (the upper 20 miles of the mainstem of the Flathead River).

In addition, flow fluctuations necessitated by power production greatly affect sediment transport, biological productivity, and nutrient cycling.

PROPOSED SOLUTION

The installation of a variable outlet depth, known as Selective Withdrawal, on Hungry Horse Dam would allow dam operations to control water temperature in the discharged waters. This is possible because the reservoir is thermally stratified with warmer water floating above gradually cooler temperature layers during the summer. Managers could withdraw water from different depths of the reservoir during the May to October period. Thus, the temperature regime could be returned to a natural condition in the South Fork of the Flathead River and the mainstem of the river downstream of the junction of the South Fork.

The Montana Department of Fish, Wildlife and Parks has estimated that Selective Withdrawal will increase trout growth in the affected portion of the South Fork by a factor of ten.

Based on a conservative computer model developed by the Department, trout growth potential in the mainstem would increase by two to five times, depending on local precipitation. Improved temperatures in the Flathead River would aid the natural timing of fish spawning mitigations from Flathead Lake and would be more conducive to the natural timing of insect life cycle events and natural insect community structure.

Temperature control can be accomplished with little or no effect on power production, and is possible over the entire range of turbine discharge capacity.

The Bureau of Reclamation estimated the cost of the selective withdrawal technology at $12.5 million in 1991. A conservative benefit/cost analysis by the Department was 1.3:1. The Department feels that this device carries a much higher, although admittedly difficult to quantify, benefit/cost ratio. Analyses by the Department have shown that Selective Withdrawal on all four penstocks at Hungry Horse Dam is the only way to achieve permanent and constant temperature control, while allowing flexibility in power production scheduling.

In March, 1991, the Montana Department of Fish, Wildlife and Parks and the Confederated Salish and Kootenai Tribes jointly submitted a *Fisheries Mitigation Plan for Losses Attributable to the Construction and Operation of Hungry Horse Dam* plan. During the 18-month public scoping period which culminated in the Plan, selective withdrawal gained significant support by an advisory group representing 24 agencies, business and special interest groups. The Northwest Power Planning Council (NWPPC) conducted a public scoping period regarding the Plan and in November of 1991 amended the Columbia Basin Fish and Wildlife Program. One of the amended program measures — 903(h)(6) — directed the Bonneville Power Administration (BPA) and the Bureau of Reclamation to "... Immediately begin actions to result in installation of a Selective Withdrawal structure at Hungry Horse Dam to allow for [downstream] temperature control to benefit resident fish."

Pilings on the north shore of Flathead Lake at Somers reflect a time when the lake was valued primarily for its economic assets, such as transportation. Today, the same area is a mecca of new commercial and residential development.

SUMMARY

Since the 1991 Council directive, little progress has been made on Selective Withdrawal. The Bureau of Reclamation included design and construction costs for the project in its 1992 budget submittal. However, the portion of the budget relating to Selective Withdrawal was deleted prior to implementation. The Council began to pursue a congressional appropriation during 1992. Late in 1992, the Flathead Basin Commission organized a meeting with Bureau of Reclamation and Montana Department of Fish, Wildlife and Parks officials and representatives of U.S. Senator Conrad Burns to further lobby for congressional support. In addition, the Commission has initiated direct communications with Montana's congressional delegation to press for approval of the funding.

COLUMBIA RIVER SYSTEM OPERATION REVIEW

The Columbia River System Operation Review (SOR) is a joint project of the Bureau of Reclamation, U.S. Army Corps of Engineers, and Bonneville Power Administration to consider changes in river operations. When the SOR began in 1990, the Columbia River was dubbed, "A System Under Stress". Growth in the northwest is putting steadily increasing pressures on the river system and there is no longer enough water to accommodate all of the demands. The SOR will produce a multiple-use operating strategy for the river system and will also provide the basis for renegotiation and renewal of the Pacific Northwest Coordination Agreement and a new Canadian Entitlement Allocation Agreement. The sponsoring agencies will also develop a method for future review and updating of the system operating strategy. Additionally, decisions made under the SOR will affect how Hungry Horse and Libby dams are operated, with associated impacts upon the Flathead and Kootenai River systems and surrounding areas.

Since 1990 the three agencies and representatives of approximately 90 different organizations and individuals from the four states in the Northwest region have participated in technical work groups that developed 90 alternative operating scenarios based upon the following 10 river uses: power, anadromous fish, resident fish, navigation, flood control, irrigation, wildlife, water quality, and cultural resources. The sponsoring agencies subsequently consolidated the 90 alternatives into 10 system operating strategies that were presented for public review and comment during September 1992. The SOR team will produce a draft EIS on the final candidate strategies by the spring of 1993 and will ultimately select an operating strategy for the Columbia River System.

Commission member Dennis Christenson explains the operation of Hungry Horse Dam during a tour by officials studying fisheries mitigation issues.

Although the system consists of both federal and non-federal dams, the SOR is examining only how strategies applied to the 14 federal dams on the Columbia and Snake Rivers affect the overall system. The 14 dams addressed by the SOR include five storage dams (Hungry Horse, Libby, Albeni Falls, Grand Coulee, and Dworshak) and nine downstream run-of-the-river projects (Chief Joseph, Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville).

The Flathead Basin Commission has taken an active role in the SOR from the outset and has assigned lead responsibility for matters related to the SOR to the Education, Information, and Recognition Committee. The Commission has invited members of the SOR Management Team to provide presentations at its meetings, and in May 1992, adopted and transmitted to the SOR team a list of values that should be preserved in the Flathead Basin. Through both its citizen members and ex-officio members representing the three SOR-sponsoring agencies, the Commission has played an instrumental role in directing the SOR to recognize and analyze impacts on the Flathead drainage and surrounding area. The Commission will continue its involvement in and oversight of the SOR as the interagency team moves forward with preparation of the draft EIS.

SEWAGE TREATMENT FACILITIES

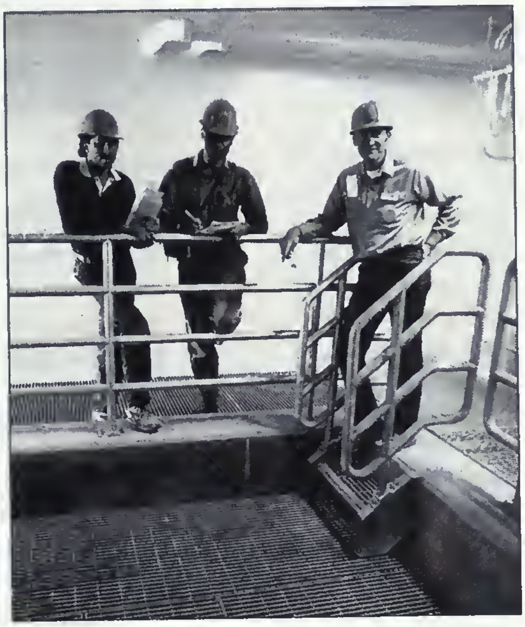
KALISPELL

After two years of work at a cost of almost $11 million, Kalispell's new waste water treatment plant became fully operational in the fall of 1992. The facility, located on the same site as the previous plant south of the city near Ashley Creek, has increased the daily processing capacity from 2.7 million gallons to 3.1 million gallons.

More importantly, the plant has dramatically enhanced the city's ability to meet higher discharge standards. The system allows phosphorous to be biologically removed and will facilitate the partial removal of ammonia and nitrogen. Under its permit, the plant must not exceed 10 parts per million BOD (biochemical oxygen demand — a measurement of the strength of sewage) and suspended solids. After its first two months of operation, the facility had reduced its discharge of total solids to less than five parts per million while the BOD measurement had dropped below 10 parts. The goal of plant superintendent, Pic Olson, is to average less than five parts for both measurements to allow for occasional fluctuations.

The reduction in phosphorous discharge has been equally impressive. The plant's permit allows a discharge of up to one part per million. In the first several months of operation the facility has averaged approximately .3 parts per million.

While the 1985-enacted ordinance to prohibit the sale of cleaning projects using phosphorous has significantly reduced the amount of the chemical that ends up in basin waters, exemptions for commercial uses such as hospitals, laundries and restaurants continue to pose water quality concerns. Operators at the Kalispell facility report dramatic increases in the presence of phosphorous on days when the city's major commercial users conduct their heaviest detergent-intensive activities.



The basin's largest municipal waste water treatment plant benefited from a $12 million modernization project in the biennium. Pic Olson, right, the Kalispell Plant's chief operator, explains its functions to Argentine civil engineer Roberto Ojeda, center, who toured the basin through a Commission-coordinated exchange program.

EVERGREEN

The Evergreen waste water collection project is proceeding toward resolution after years of delay. The system will involve 79 miles of pipe and 23 lift stations and will serve residents in the most populated unincorporated community in the state. At a projected cost of approximately $14 million, 40 percent of which will be funded through an EPA grant. The system will cost each Evergreen homeowner up to $4,000. In December of 1992, the Evergreen Water District was still attempting to arrange the sale of bonds to partially cover the expense of the project. Additional funding will come through loans obtained by a recently-created SID (Special Improvement District). The collected waste will be pumped to Kalispell for processing by the new city treatment plant.

SUMMARY

Given the high water table in the Evergreen area and the community's population density, the construction of the waste water collection system has long been a water quality priority. The resolution of Evergreen's waste water collection and treatment problem will represent a major improvement in the basin's overall water quality picture. Likewise, the upgrading of Kalispell's treatment facility has had an immediate positive effect on the water quality of Ashley Creek and the Flathead River.

THE HEART OF THE COMMISSION: WATER QUALITY MONITORING

EXECUTIVE SUMMARY

A primary goal of the Flathead Basin Commission is to identify existing or potential water quality problems in the basin and to identify the sources of these problems. Various agencies under the auspices of the Flathead Basin Commission work together to monitor water quality and fisheries.

Under the "Master Plan for Monitoring Water Quality in the Flathead River Basin," researchers regularly collect data to establish "baseline" water quality conditions, to detect trends in water quality at selected sites, to detect and document sources and causes of water pollution, to measure the integrity of select biological communities by monitoring the habitat and populations of indicator species (such as *Mysis* shrimp, westslope cutthroat trout, and bull trout), and to develop predictive relationships between key hydrological, chemical, physical, and biological variables.

This section of the *Biennial Report* is a progress report pertaining to the overall objective of monitoring water quality in the Flathead River Basin. The researchers involved in this monitoring process have not attempted to interpret thoroughly all the data in the water quality monitoring database. Rather, they have identified and analyzed key findings. Some of their conclusions and recommendations are listed below.

CONCLUSIONS

Although researchers found that Flathead River Basin waters are very clean, the rapidly increasing human population has undesirably affected the basin's waters. Researchers have identified a deterioration in the quality of water and fisheries in the Flathead Basin. For example, researchers have noted:

- that the thermal effects of deep water discharges from Hungry Horse Dam have been harmful to trout growth and other aquatic life since the construction of the dam in the early 1950s;

- an increasingly clear trend toward higher productivity of phytoplankton (algae) in Flathead Lake which is being fertilized by excess nutrients;

- increasing loads of nutrients from the drainage basin and from polluted precipitation generated by the increased development;

- dramatic changes in the food web of Flathead Lake caused by the introduction of *Mysis* shrimp that continue to be a problem for fish and zooplankton populations;

- reduced dissolved oxygen levels in the bottom layers of Flathead Lake;

- that Whitefish Lake is on the threshold of change and is not being monitored;

- that the study lakes of Glacier National Park, which reflect the pristine attributes that stimulated the creation of the Park and its designation as a Biosphere Reserve, clearly have very little buffer capacity and are very sensitive to acid deposition and increased phosphorus from human activities;

- a serious decline in the bull trout populations from Flathead Lake which spawn in tributaries to the North and Middle Forks of the Flathead River which could lead to an "endangered species" listing;

- an increased number of non-native lake trout and lake whitefish far upstream in the Flathead River which may be eating young bull trout and crowding them out of their habitat;

- habitat degradation and other factors which could cause significant declines in the basin's unique westslope cutthroat trout population; and

- that timber harvest activity and attendant road building can lead to increased suspended sediment concentrations, higher concentrations of nutrients (nitrogen and phosphorus), more fine sediment in trout spawning gravels, increased gravel embeddedness, and greater algal growth in streams.

Researchers also identified several positive developments related to water quality and fisheries in the Flathead Basin such as:

- ◊ the nutrient reduction programs of the Flathead Basin Commission and the Water Quality Bureau are probably working;
- ◊ some recovery of tributary fish habitats has occurred since 1989, probably due to the natural flushing of sediment from streams;
- ◊ the size and number of westslope cutthroat trout in the upper South Fork of the Flathead River now appear to be stable; and
- ◊ various public and private organizations have been expanding and improving the application of Best Management Practices.

RECOMMENDATIONS

The monitoring data clearly show that the quality of water in the Flathead Basin is deteriorating. The quality of life and a sustainable economy depend on good quality water. Therefore the future of the Flathead Basin depends on how well decision-makers understand the damaging effects of human activities and whether they heed the warning signs and adjust management activities accordingly.

To respond to the decline in water quality, the ***agencies identified in the "Master Plan for Monitoring Water Quality in the Flathead River Basin"*** should:

- ◊ continue to cooperate with the Flathead Basin Commission and other agencies in the monitoring of water quality variables and other activities;
- ◊ maintain the current Flathead Basin monitoring program; and
- ◊ allocate more time for their scientists to work interactively with scientists from other agencies to gain insight on solutions to the problems.

To respond to the decline in water quality, the ***Flathead Basin Commission*** should:

- ◊ encourage public decision-makers to immediately fund a project for constructing a mechanism at Hungry Horse Dam that would allow for water releases from various depths in the reservoir to reduce thermal effects below the dam;
- ◊ continue its involvement with the Columbia River System Operation Review recognizing the potential effects on the Flathead Basin of changes in downstream management practices;
- ◊ encourage government officials and agencies, as well as organizations and individuals, to work cooperatively to respond to the "Recommendations" in this "Water Quality Monitoring Report;"
- ◊ encourage all land owners to cooperate through their local conservation districts or the Montana Cumulative Effects Cooperative in minimizing the cumulative effects of all land use activities which affect water quality;
- ◊ seek funding for the monitoring program as proposed by the Technical Committee;
- ◊ request that counties establish a mechanism to require developers in the basin to help provide funding for this essential water quality monitoring program;
- ◊ update its "Master Plan for Monitoring Water Quality in the Flathead River Basin" as needed based on the recommendations of the Technical Committee;
- ◊ revise the "Master Plan" to adequately address cumulative effects and sources of impairment by incorporating additional sampling sites in tributaries of the Flathead River, in Flathead Lake, and in Whitefish Lake;
- ◊ establish and maintain an integrated and interactive water quality and fisheries database;
- ◊ encourage the funding of the U.S. Geological Survey's streamflow gauging stations;
- ◊ consider petitioning the Montana Board of Health and Environmental Sciences to have critical bull trout spawning streams listed as National Resource Waters under the Montana Water Quality Standards and Nondegradation Rule;
- ◊ support efforts to develop criteria related to the allowable amount of deposited sediment, percentage of fine sediment, substrate scores,

bedload, and suspended sediment in critical bull trout and westslope cutthroat trout streams;

◊ support funding for a study to determine the effectiveness of Best Management Practices in protecting water quality;

◊ study the effects of slash burning, wood stoves, wood heaters, natural fires, and other sources of smoke on the nutrient content in atmospheric deposition;

◊ continue to inform public decision-makers of the key findings of the Flathead Basin Commission so they can develop strategies for limiting new and reducing existing pollution sources; and

◊ intensify its efforts to inform individuals and organizations about how they can protect water quality in the Flathead Basin.

To respond to the decline in water quality, ***land owners and managers*** should:

◊ continue to improve the application of Best Management Practices (along with other soil and water conservation practices) in the management of their lands and

◊ restrict management activities to those which do not increase sediment loads to critical bull trout spawning streams.

To respond to the decline in water quality, ***individuals and organizations*** should:

◊ encourage local governments to implement planning mechanisms that will minimize degradation of water quality;

◊ ensure that developers be held accountable for their cumulative effects on the basin's water quality and that they help fund the monitoring program;

◊ reduce use of cleaning agents, fertilizers, pesticides, and other products harmful to the environment;

◊ voluntarily limit use of wood stoves and wood heaters because the smoke contains phosphorus which pollutes surface waters; and

◊ actively participate in monitoring water quality through the Flathead Basin Commission's Volunteer Monitoring Program and through other programs.

The water quality in the Flathead Basin is deteriorating. We must work together to stop the decline in water quality and preserve our quality of life.

BACKGROUND

WHY MONITOR WATER QUALITY?

What do people think of when they picture a land of pristine waters? Do they see themselves walking along cold, clear streams? Canoeing on open lakes? Battling fish they have hooked? These images reflect various aspects of relatively pure water. How would someone know if water quality in these settings had declined? The stream might be murky, the lake might be choked with aquatic plants, or an angler might not be able to entice a fish with a lure.

These examples involve aspects of water quality in the "big picture." However scientists measure water quality using specialized techniques and sensitive indicators. They monitor the amount of various chemical substances dissolved and suspended in the water. They also check such things as the condition of stream bottoms and lake shores, the status of fish populations, and the clarity of water.

From 1979 through 1983, researchers for the Flathead River Basin Environmental Impact Study gathered and analyzed data related to various aspects of water quality. These data set the baselines for measuring changes in water quality. The researchers also explored the environmental relationships in the Flathead River Basin ecosystem and identified ways to conserve the basin's human and natural values.

The Flathead River Basin Environmental Impact Study concluded that waters of the basin were generally very pure. However, the study documented a trend of declining water quality. Natural and man-made pollution in Montana and British Columbia threaten the generally pristine nature of the basin's water and aquatic life.

No one wants the waters of the Flathead Basin degraded below state water quality standards. People want to preserve the Flathead Basin's relatively pristine aquatic environment. The final report of the Flathead River Basin Environmental Impact Study noted that, "the public would be willing to pay an estimated $97 million annually to protect water quality values." To protect water quality values, people must know how and why water quality has changed.

One of the Flathead Basin Commission's goals is "to identify existing or potential water quality problem areas in the basin and to identify the parameters causing the problems." Various agencies under the auspices of the Flathead Basin Commission work together to monitor water quality. (See Table 1.) They have expanded the inter-agency water quality database begun by the Flathead River Basin Environmental Impact Study.

In 1986 the Commission adopted a "Master Plan for Monitoring Water Quality in the Flathead River Basin." Under this Plan, researchers regularly collect data. The Plan's objectives are:

(1) To establish "baseline" water quality conditions.

(2) To detect trends in water quality at selected sites.

(3) To detect and document sources and causes of water pollution.

(4) To measure the integrity of select biological communities by monitoring the habitat and populations of indicator species (such as *Mysis* shrimp, westslope cutthroat trout, and bull trout).

(5) To develop predictive relationships between key hydrological, chemical, physical, and biological variables.

This section of the Flathead Basin Commission's *Biennial Report* describes the cooperating agencies' progress related to the monitoring activities specified under the "Master Plan for Monitoring Water Quality." The researchers involved with this monitoring process have not attempted to interpret thoroughly all the data in the database. Rather, they have identified and interpreted key findings.

FLATHEAD RIVER BASIN

Various man-made boundaries cross the drainage which constitutes the Flathead River Basin. The basin stretches from the river's headwaters in the southeastern corner of British Columbia to the confluence of the Flathead and Clark Fork Rivers near Paradise, Montana. The Flathead River receives water from an area of nearly six million acres. (See Figures 1A and 1B.)

HOW DOES THE WATER CYCLE WORK?

Most water is retained in the Flathead River Basin system for only a short period of time as part of the water cycle. As a simple example, this process

Table 1: Resource management agencies involved in the collection of data under the "Master Plan for Monitoring Water Quality in the Flathead River Basin."

Confederated Salish and Kootenai Tribes	Stream water quality Fisheries inventories Flathead Lake water quality[1]
Flathead County	Flathead Lake water quality[1]
Glacier National Park	Glacier National Park water quality
Lake County	Flathead Lake water quality[1]
Montana Department of Fish, Wildlife and Parks	Fisheries inventories[2] Thermal monitoring of Flathead River
Montana Department of Health and Environmental Sciences, Water Quality Bureau	Flathead Lake and tributary water quality[1]
Montana Department of State Lands	Stream water quality[3]
Montana Power Company	Flathead Lake water quality[1]
United States Forest Service	Stream water quality Fisheries inventories
United States Geological Survey	Hydrological measures

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[1] Contracted to Flathead Lake Biological Station (University of Montana).

[2] The U.S. Forest Service participated in and paid for a portion of the monitoring done by the Montana Department of Fish, Wildlife and Parks.

[3] Plum Creek Timber, Inc. paid for analysis of water quality samples collected by the Montana Department of State Lands on Lazy Creek in the Swift Creek drainage

might begin when moisture evaporates from the Pacific Ocean into the atmosphere. If that air mass moves inland, it may hold its moisture until reaching a barrier such as the Swan Mountain Range. Uplifting over the mountains cools the air mass, and the water may condense forming a cloud. Additional uplifting or cooling may cause the cloud to release its moisture as rain or snow. The highest mountains receive about 70 inches or more of precipitation annually, whereas the valleys receive only about 15 to 20 inches annually. Once the precipitation reaches the mountainside, some of it will run off, some of it will evaporate, some of it will enter vegetation, and the remainder will percolate through the soil into the groundwater. Most of the groundwater will eventually emerge as a spring or enter directly into a creek or lake.

As water moves downhill, the runoff combines to make a creek that will merge with other creeks to form a stream and eventually a river. Ponds or lakes may occur at any stage along the way.

Water may remain in a pond or lake for varying periods of time. In deep lakes, the water stratifies during the summer. The upper layer is warmed by the sun, while the lower layer remains cool and isolated. Cool water is more dense than warm water, and the water in the lower layer will not mix with the water in the upper layer until autumn, when both layers are the same temperature. A river entering a lake will seek its own level of corresponding temperature and density.

Once water reaches Flathead Lake, it will remain there on average less than three years. After traveling

Figure 1A: Upper Flathead River Basin Showing Water Quality Monitoring Stations

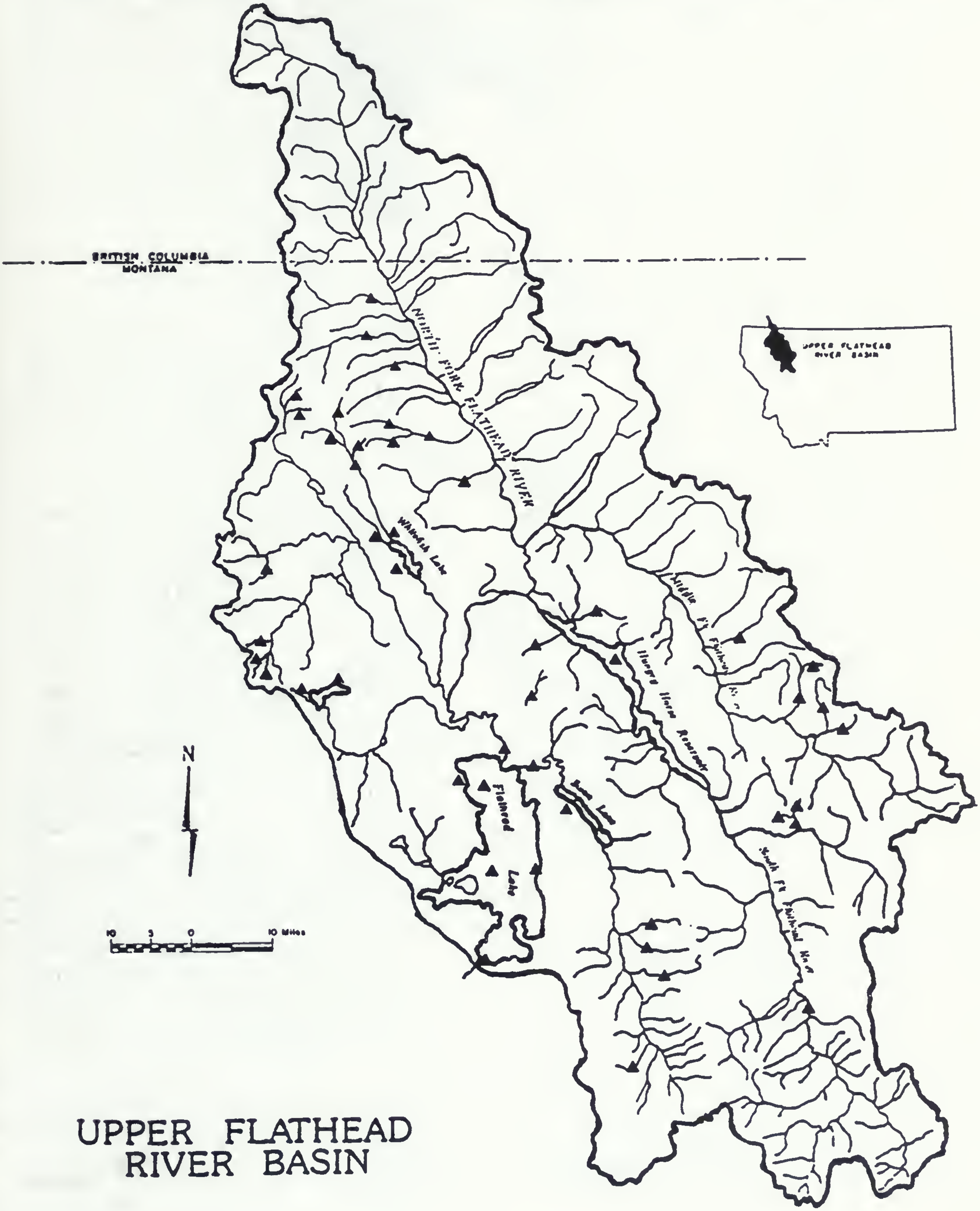
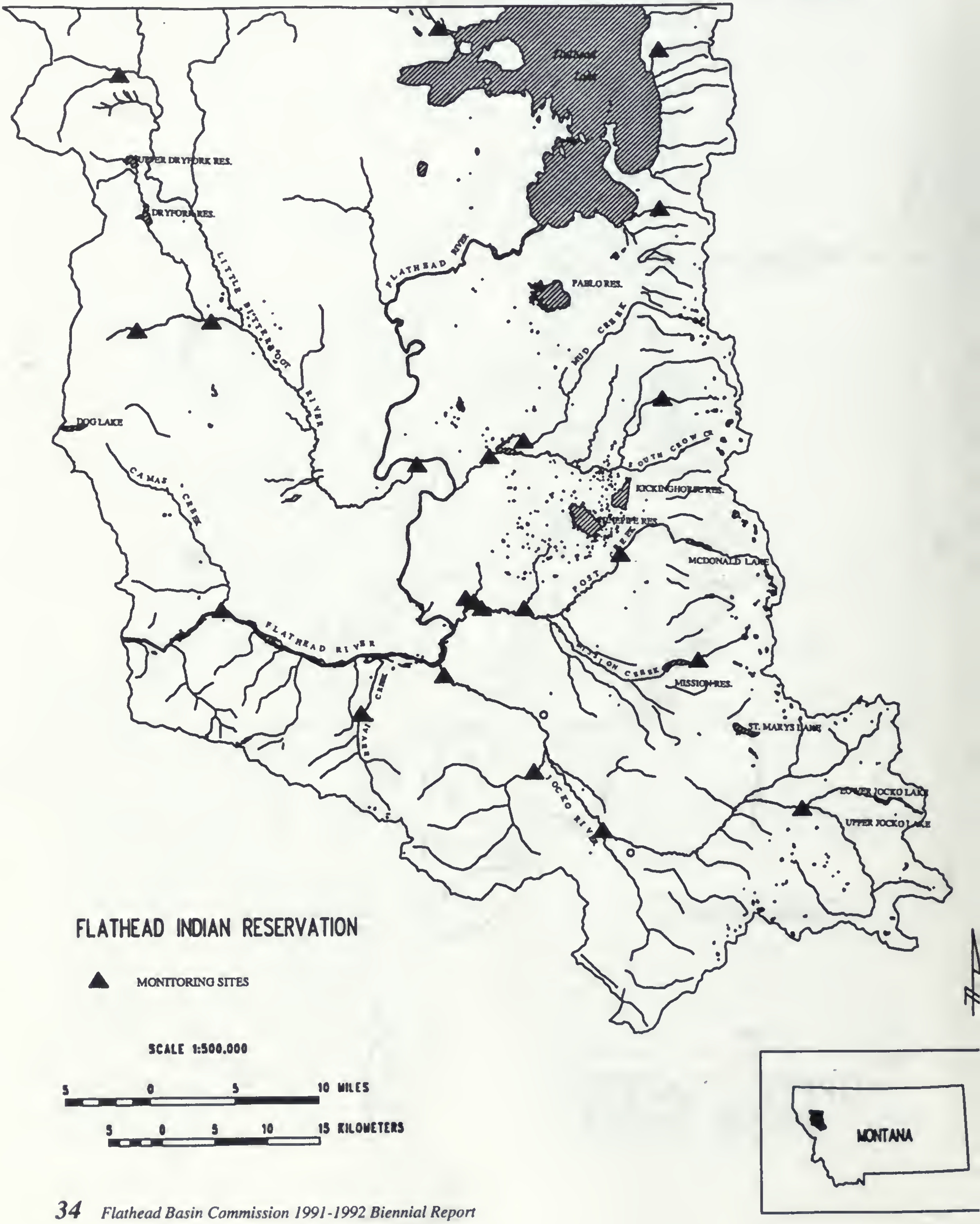


Figure 1B: Flathead Indian Reservation Showing Water Quality Monitoring Stations



through the lake it will be discharged into the lower Flathead River. During that time, most of the suspended sediments will settle out of the water and onto the lakebed. Therefore, the water leaving Flathead Lake at Polson will be clearer than when it entered. The water in the Flathead River will join the Clark Fork River, then the Pend Oreille River, and finally the Columbia River. In the end, the water that entered the Flathead River Basin as precipitation will drain from the Columbia River into the Pacific Ocean, and the water cycle will begin again.

FACTORS INFLUENCING WATER QUALITY IN THE FLATHEAD RIVER BASIN

Freshwater ecology is the study of animals and plants in relation to their aquatic environment. Lakes and streams in the Flathead Basin support many biological species, and this diversity reflects the generally pristine condition of the basin's waters. A few of these species exist nowhere else in the world.

While the aquatic species of the basin are notably unique and diverse, individual populations are not normally abundant. The generally sterile nature of the basin's waters and the relatively short growing season limit population growth. Surface waters of the Flathead Basin contain relatively few essential plant growth nutrients (such as nitrogen and phosphorus). This reflects the underlying geology of the area. The relative shortage of such nutrients naturally limits the production of algae and other plants. In turn, the relative shortage of plants limits the populations of fish and other aquatic animals that feed on them. Without large amounts of nutrients, these waters cannot support the luxuriant growths of algae and bacteria that characterize more fertile or even polluted waters.

The naturally low productivity of aquatic plants and animals in the Flathead River drainage is a result of the basin's high quality waters. Increases in productivity may indicate declines in water quality. However, water quality does change seasonally. Suspended sediments in water increase markedly during spring runoff — the water becomes cloudy and carries additional nutrients. These nutrients may temporarily increase the productivity of the plants and animals living in the streams and lakes of the basin.

In the Flathead Basin, nutrient supply delicately balances the diversity and abundance of living organisms. Even small additions of polluting nutrients may result in nuisance "blooms" (population explosions) of aquatic plants. In addition, such nutrients might encourage the proliferation of undesirable fish species. The native species of aquatic animals have adapted to low levels of plant growth and no single species can out-compete the others for the available forage. Over the millennia this has allowed an exceptionally large number of species, none of them very abundant, to coexist. For example, the Flathead River Basin contains almost one-fourth of the known North American stonefly species. Anything that disrupts this delicate balance is a threat to the water quality of the basin. This includes the introduction of non-native species.

Rain, snow, smoke, and dust drop nutrients such as phosphorus onto surface waters. The nutrients in this atmospheric deposition come from such things as slash burning, internal combustion engines, wood stoves, industrial combustion sources, and atmospheric fallout.

The Flathead Basin's unique fishery is one component and product of the area's high water quality. More than 20 native and introduced fish species reside in streams and lakes of the Flathead Drainage. Montana's Department of Fish, Wildlife and Parks considers bull trout and cutthroat trout "species of special concern." This designation recognizes the limited range of the trout and their sensitivity to habitat degradation, to angler harvesting, and to potential competition or hybridization with non-native fishes.

These fish mature in large lakes, but then migrate upstream into the rivers and tributary creeks to spawn. The eggs hatch and after a period of time the juvenile fish migrate back downstream into the lakes to grow and complete the cycle. This migratory pattern is significant because the fish are sensitive to environmental changes throughout the entire aquatic system. Since they are sensitive to changes in their habitat, they can be excellent indicator species for long-term monitoring of habitat integrity.

CAUSES OF DECREASED WATER QUALITY

Natural and human-caused events can lead to the deterioration of water quality. For example, water clarity "naturally" decreases and suspended sediment and nutrient loads "naturally" increase during spring runoff, even in headwaters in wilderness areas. Also, *Giardia lamblia*, a protozoan that can infect humans, may be present in waters "naturally" because their cysts are spread by wild animals.

Virtually all land use activities ultimately affect water quality. Many land management agencies have specific duties to implement laws and apply regulations to protect water quality. The principal laws are the federal Clean Water Act and its counterpart, the Montana Water Quality Act. The goals of the Montana Water Quality Act are similar to those of the Clean Water Act. Montana's Act proscribes water pollution and contains the primary enforcement mechanism for prohibiting, enjoining, and penalizing pollution. A permit system regulates point sources of pollution (such as sewage systems) and Best Management Practices (BMPs) are designed to control nonpoint sources of pollution (diffuse sources of pollutants resulting from natural occurrences and human activities over a relatively large area). Most water pollution in the basin comes from nonpoint sources.

Other laws and regulations that affect water quality in the Flathead Basin are:

- the Streambed and Land Preservation Act (which regulates development activities taking place in streams and lakeshores);
- the Public Water Supply Law (which regulates logging and other activities with respect to their impact on water quality in watersheds used for public water supplies);
- the Sanitation in Subdivisions Act and the Subdivision and Platting Act (which together provide for state and local review of proposed subdivisions); and
- the Shoreline Protection Ordinance (which regulates certain structures, dredging, and filling below the high water mark on Flathead Lake and on Flathead River and its major tributaries within the Flathead Indian Reservation).

Actions such as agricultural practices; forest management practices; dams and other stream regulation; mining, oil and gas extraction; and urbanization are common contributory sources of human-related water alteration or pollution. Common causes of water pollution include excess nutrients, sediment, changes in water temperature, and altered stream flows or lake levels.

Many studies in other forested drainages have shown that runoff erodes sediments from roads and logging skid trails. This erosion can decrease water quality by increasing turbidity, increasing nutrient loads, and smothering aquatic life.

HOW IS WATER QUALITY MONITORED?

Water chemistry, streamflow, turbidity, sediments, water temperature, and other factors affect water quality. Since fish live in water, the same variables strongly affect them.

Researchers measure fish habitat quality by looking at the size and amount of fine materials in streambeds and the emergence success of fry from gravels. They analyze fish populations by measuring the number and size of fish and by counting redds (nests built by spawning fish). They also monitor zooplankton (minute animals eaten by fish) to determine their effect on fish populations.

The 1986 *Master Plan for Monitoring Surface Water Quality in the Flathead Basin* lists the array of over 50 monitoring sites. Researchers monitor water quality variables at most of these sites. The sites were selected based on a range of issues and concerns. They cover a variety of Flathead Basin water bodies, including Flathead Lake. The sites also represent major land ownerships in the basin, including the Flathead National Forest and the Stillwater State Forest. (See Figures 1A and 1B.)

Researchers use standard techniques for the collection and analysis of hydrological, chemical, and biological data, and to assure precise and reliable data. This Water Quality Monitoring Report is derived from various reports and from discussions between the researchers. The basic reports include:

(1) "Monitoring Fisheries Habitat and Fish Populations in the Flathead Basin" (By Tom Weaver, Montana Department of Fish, Wildlife and Parks, November 1992).

(2) "Surface Water Quality of the Stillwater State Forest" (By Mark D'Aversa and Gary Frank, Forestry Division, Montana Department of State Lands, November 1992).

(3) "Chapter 5 — Fisheries" from the *1991 Annual Monitoring Report of the Flathead National Forest* (By Mike Enk and Pat Van Eimeren, Flathead National Forest, 1992).

(4) "Chapter 8 — Water" from the *1991 Annual Monitoring Report of the Flathead National Forest* (By Wally Page, Flathead National Forest, 1992).

(5) "Monitoring Water Quality in Flathead Lake, Montana. 1992 Progress Report" (By Jack A. Stanford, Bonnie K. Ellis, Dale W. Chess, James A. Craft and Geoff C. Poole, Flathead Lake Biological Station, The University of Montana, 1992).

(6) "Monitoring Water Quality of Selected Lakes in Glacier National Park, Montana" (By Bonnie K. Ellis, Jack A. Stanford, James A. Craft, and Dale W. Chess, Flathead Lake Biological Station, The University of Montana and Gary R. Gregory and Leo F. Marnell, Glacier National Park, National Park Service, 1992).

(7) "Flathead Basin Commission: Biennial Report Water Quality Monitoring — Lower Flathead River Basin/Flathead Indian Reservation" (By Dave Haire, Water Quality Program, Confederated Salish & Kootenai Tribes, 1992).

(8) *Flathead Basin Forest Practices Water Quality and Fisheries Program Final Report* (Published by the Flathead Basin Commission, 1991).

Individuals can obtain copies of these reports from the Flathead Basin Commission's Public Information Officer (Mark Holston, 723 Fifth Avenue East, Kalispell, Montana 59901, 406-752-0081).

WATER QUALITY IN HEADWATER STREAMS

WATER FLOW

The amount of precipitation in the Flathead River Basin varies both annually and seasonally. When annual precipitation is lower than normal, less water flows into creeks and into the groundwater, so streams discharge less water into Flathead River and Flathead Lake. Figure 2 shows the average annual flow for the 82-year period from 1911 through 1992 for the North Fork of the Flathead River. Annual flow variations for the North Fork appear to be representative of other streams and rivers in the Flathead River Basin. Annual North Fork Flathead River flows were below average in 1986, 1987, 1988, 1989, and 1992, and above average in 1990 and 1991.

Snowmelt in the mountains provides most of the water for the Flathead River Basin. The greatest variations in water flow occur when the snow is melting, especially when coupled with periods of spring rain and alternating warm and cool weather. Figure 3 shows the daily flows in 1991 for two representative tributaries — the North Fork of the Flathead River and Coal Creek. The months of May and June account for about 60 percent of the annual flow volume. Most streams show at least a 50-fold variation between minimum and maximum flows within a year. In summer and fall, rains may or may not increase the flow of water. However, flow can respond dramatically after prolonged heavy late season rain storms.

In addition to natural events, dams regulate stream flows and lake levels. Dam regulation affects water temperatures and the organisms growing in the water as well as the amount of water available. Some thermal effects related to the operation of Hungry Horse Dam are described in later sections of this report.

WATER TEMPERATURE

If too much of the canopy is removed over a short time period, timber harvesting along stream banks can lead to increased water temperatures in streams. Fortunately, the bull trout streams and many of the westslope cutthroat trout streams in the Flathead National Forest are buffered by extensive ground water recharge. In addition, alder, willow, or mountain maple quickly close over most small tributaries after overstory removal. Therefore, temperatures in feeder streams often rapidly return to appropriate levels. The Streamside Management Zone Act (HB 731) requires that canopy cover be retained over all intermittent and perennial streams affected by forest practices.

In 1986, field crews started collecting water temperature information at water quality and fisheries monitoring stations in Whale, Coal, and Big Creeks. In 1991, maximum water temperatures (that is, mid-summer peaks) did not exceed 13.0° C (56° F) in the monitored bull trout streams. Optimal temperatures for bull trout and westslope cutthroat trout are 12°-14°C. Preferred temperatures are lower for bull trout eggs and juveniles. The maximum temperature for the 6-year monitoring period was 14.6° C (59° F) recorded in 1988 at the Coal Creek station.

Water temperature measurements over the past 5 seasons indicate that mid-summer peak temperatures were of short duration and well below the level at which stress would be imposed on juvenile trout. Overall, water temperatures in streams remain within the desirable range for westslope cutthroat trout and bull trout.

TURBIDITY AND SEDIMENTS

Water dissolves, dilutes, transports, and deposits substances found on land, in the air, and in the water. Surface water from rain or snowmelt picks up sediment and debris on its way to join creeks. Water flowing in a stream may also churn up the stream-bottom sediments and erode stream banks. Most of this erosion is natural — a function of topography, geology, plant cover, and weather. Human activities trigger other erosion. For example, road building, logging or agricultural practices, mining, oil and gas extraction, and other land development can increase surface runoff and, thus, the movement of sediments. The larger the stream discharge, the more energy there is to erode and transport sediments and the higher the concentration of suspended sediments.

Sediments in streams are mostly inorganic (sand, silt, and clay), but may also include tiny bits and pieces of plant and animal remains (organic matter). Suspended sediments are materials carried by the water. Streams with more sediment available for

Figure 2: North Fork of Flathead River
Average Annual Flow 1911-1992

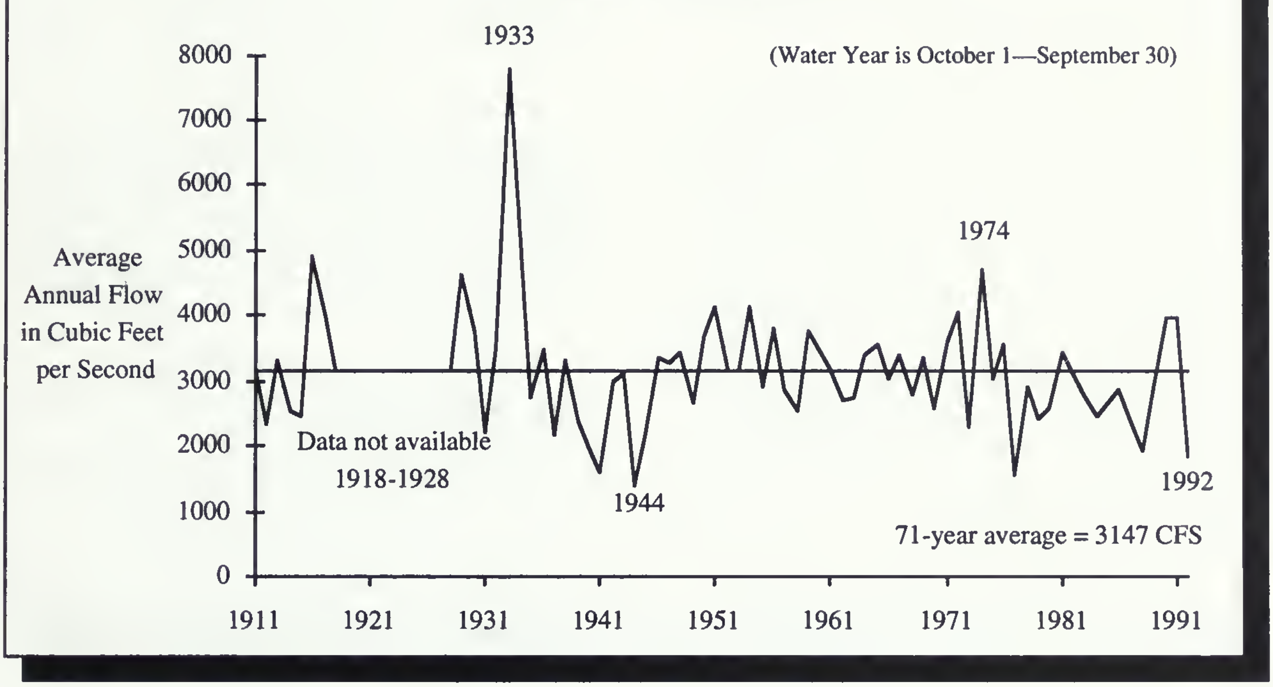
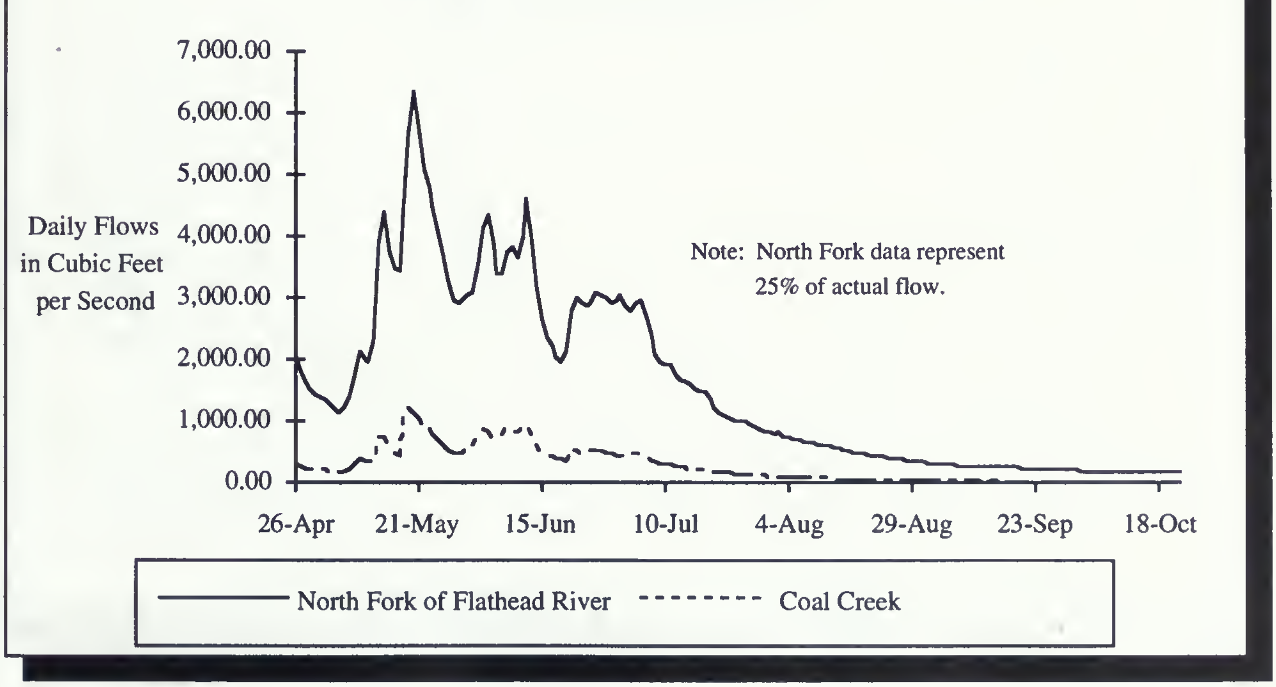


Figure 3: North Fork of Flathead River and Coal Creek
1991 Daily Flows



transport will normally have more suspended sediment in their discharge (a supply-based concept). Another relationship between sediment and discharge is that in a year when water flow is low, sediment discharge generally is also low (an energy-based concept). Changes in the sediment-to-discharge relationship may indicate changes in water quality.

Turbidity is haziness or cloudiness in water caused by suspended sediments. The Montana Surface Water Quality Standards permit no turbidity increases above "naturally occurring" levels in large portions of the upper Flathead River Basin, including Flathead Lake. Turbidity levels for all monitored streams ranged from less than 1 to 580 Nephelometric Turbidity Units (NTU). (A turbidity rating of 8 to 10 NTU means that there is visible muddiness — that the water is slightly milky.) Most turbidity increases do not last long. They often occur during bank-full discharges caused by spring snowmelt and after high intensity rainstorms. In both 1990 and 1991, Big Creek, a tributary of the North Fork of the Flathead River, had the highest recorded NTUs.

Krause Creek (just east of Kalispell) is an anomaly in the Flathead River Basin drainage. It has naturally high mean turbidity levels (53 NTU in 1986 and 50 NTU in 1987). (These measurements were discontinued in 1988.) Glacial till (unstratified silt strewn with stones produced by the grinding action of glaciers) in the Krause Creek drainage is eroding naturally. This causes debris avalanches. Sediments from this mass-erosion process enter upper stream reaches and increase the creek's turbidity and sediment load.

Along with high turbidity levels, Krause Creek has the highest average measured sediment concentration (287 milligrams per liter). In contrast, the streams in the Tally Lake Ranger District flow from areas with gentler slopes and low mass erosion. They have some of the lowest average sediment concentrations (generally less than 4 milligrams per liter) in the Basin.

Hydrologists use trends and deviations from normal suspended sediment concentrations and loads to measure and detect changes in water quality. Figures 4 and 5 display suspended sediment yields for several creeks. Like streamflows, sediment yields generally were much larger than average in 1991. Annual total suspended sediment loads at most monitored streams showed an upward trend. Sixteen of twenty-three monitored streams had above average sediment discharge and 10 of these had the highest

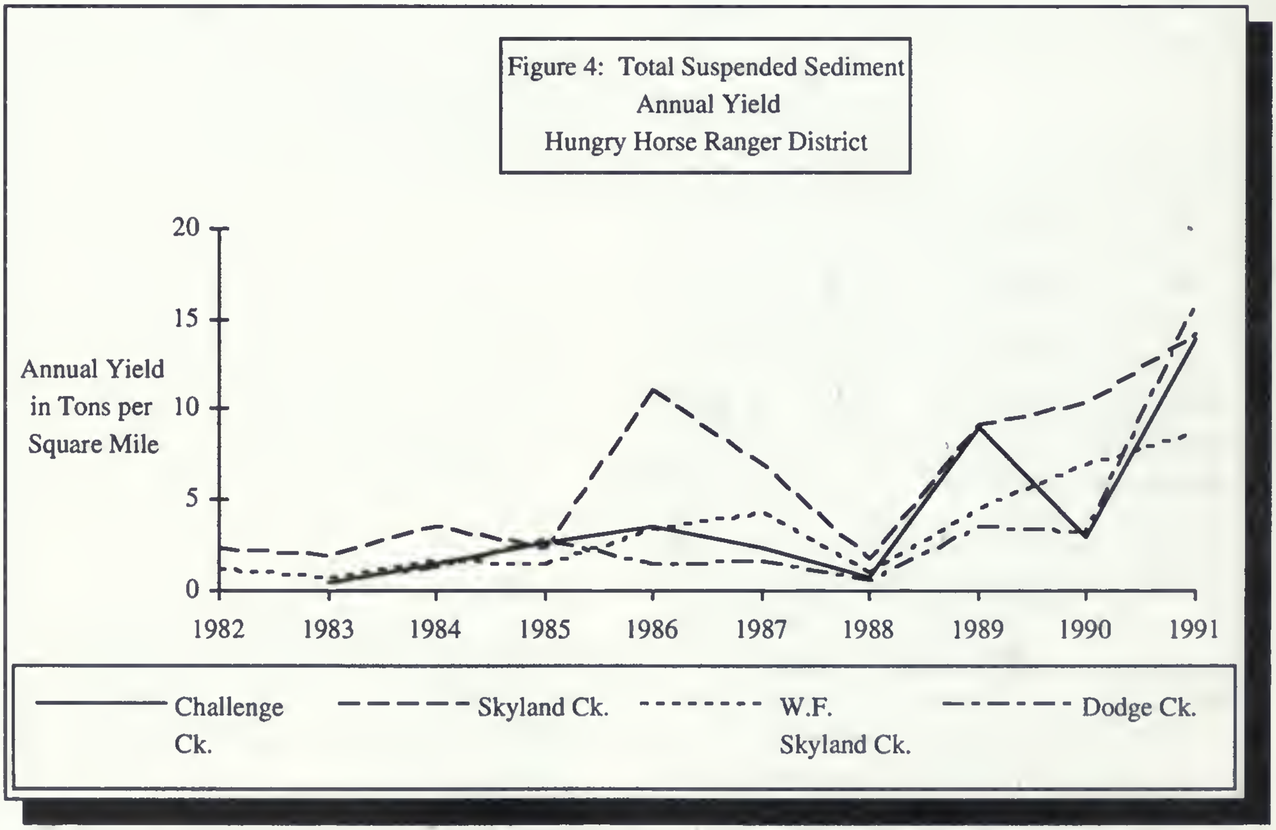


Figure 4: Total Suspended Sediment
Annual Yield
Hungry Horse Ranger District

Figure 5: Total Suspended Sediment
Annual Yield
Glacier View Ranger District

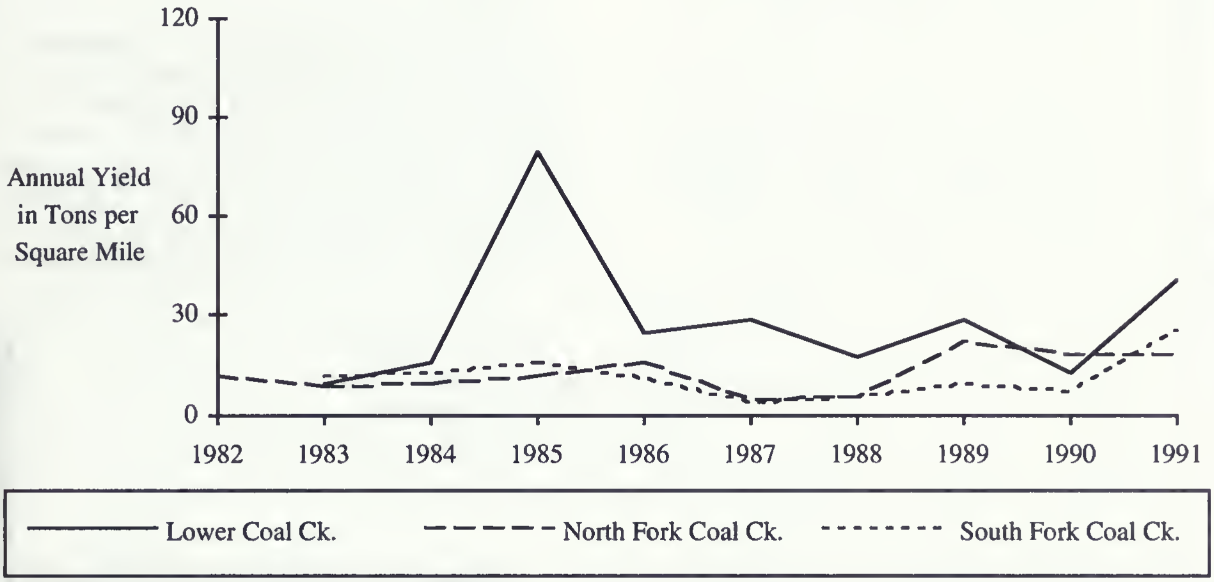
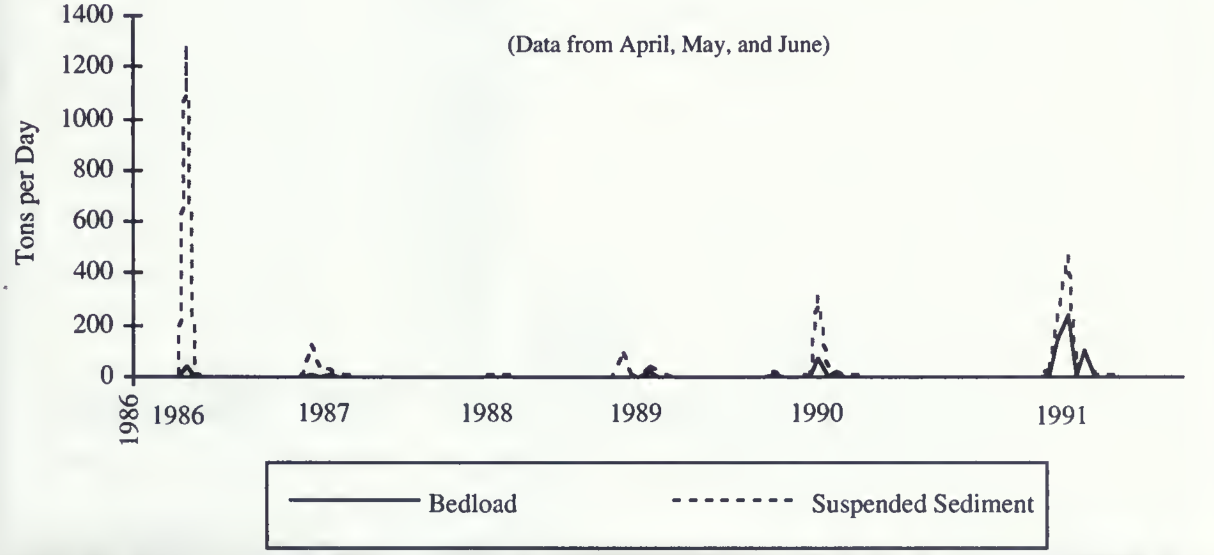


Figure 6: Bedload and Suspended Sediment
in Big Creek
Glacier View Ranger District



measured for the period of record. Extended bank-full streamflow occurred primarily from snowmelt runoff and rain storms when soils were at water holding capacity. Flooding conditions on Big Creek in 1991 caused a significant increase in bedload transport. (See Figure 6.) It is apparent from upstream/downstream measurements at Big Creek and Wounded Buck Creek that much of the sediment load comes from streambank and bed erosion.

Increasing trends of sediment loads in some Flathead National Forest streams are evidently due to bank-full stream discharges, frequency and duration of precipitation (rain and snow), and activities such as timber harvest and road development. Water is intercepted, concentrated, and drained into stream channels with greater efficiency at roads, and more water from precipitation becomes available for runoff in harvested units. The energy from bank-full discharges can reshape channels, especially when the channels are not stable because roots or other debris have been removed.

Swift Creek is a major tributary of Whitefish Lake. The average annual yield of suspended sediments over the period from 1976 through 1991 in Lower Swift Creek (as measured at Crain's Ranch) was 176 tons per square mile. This yield was 6 to 60 times higher than average yields at some of the other sites monitored. (See Figure 7.) Annual suspended sediment yields at stations further upstream on Swift

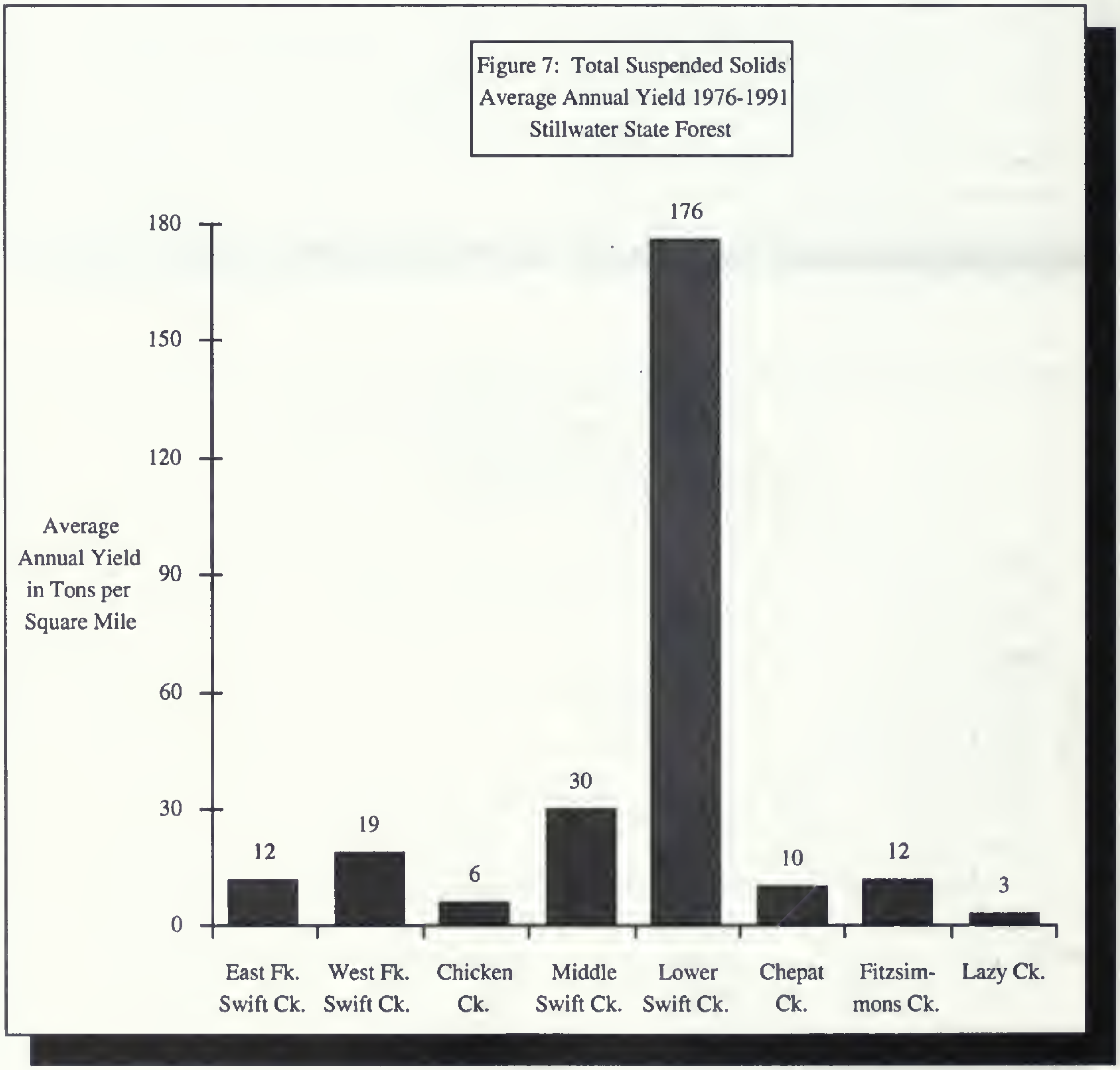


Figure 7: Total Suspended Solids
Average Annual Yield 1976-1991
Stillwater State Forest

Creek indicate sedimentation rates within the range expected for similar geological areas in a natural state.

Suspended sediment concentrations and yields for Lower Swift Creek are consistently 5 to 10 times greater at high flow than for Middle Swift Creek (as measured at the Concrete Bridge). The annual suspended sediment yield for Lower Swift Creek is 6 times greater than for Middle Swift Creek, and 8 times greater than for the West Fork of Swift Creek. Other than Krause Creek, Lower Swift Creek (at Crain's Ranch) is the only station to have suspended sediment concentrations periodically above 100 milligrams per liter. (This occurred in 21 of the 169 samples taken.) Approximately 80% of the average annual suspended sediment yield in Swift Creek comes from the channel's lower eight to ten miles. Lower Swift Creek is undercutting glacial fluvial gravels and old lake deposits (clay banks). Natural erosion of these deposits along the creek's lower reaches provides a large supply of sediment and causes the high yields measured.

Statistical analyses show that as water flow increases, the suspended sediment concentration generally increases. The exact relationship varies with different seasons, different streams, and different years. This information is important since the concentrations of suspended sediments closely correlate with the amounts of phosphorus nutrients available.

Waters in the Stillwater State Forest have inflated total suspended sediment concentrations during spring snow melt and subsequent runoff. The problem is ephemeral and poses no long-term degradation in water quality for the streams affected. (Note, however, that sediment accumulation is causing problems with fish habitat.) In fact, given the physical and geological setting, the magnitude of the total suspended sediment concentration flux seems quite natural and is likely the result of a highly erodible landscape and not forest management activities. Total suspended sediment yields for stations close to forest management activities (those sites where impacts would be expected to be detectable) seem to be within the range of values represented as natural variation.

Chicken Creek is a baseline station — it measures water quality from a creek in a drainage relatively undisturbed by humans. Portions of the Swift Creek drainage, on the other hand, have been logged. Land managers have harvested considerable amounts of timber and built many roads in the drainages of both the West and East Forks of Swift Creek. For the period from 1976 through 1991, Chicken Creek's average annual suspended sediment yield in tons per square mile was only about one-third of the suspended sediment yields at the West Fork of Swift Creek and the East Fork of Swift Creek. (See Figure 7.)

Bedload consists of the transportable material at the bottom of a water channel. Bedload movement may scour stream bottoms during spring runoff or violent storms. This scouring prevents widespread accumulations of sediments in the upper reaches. In addition, when the stream redeposits the bedload, the materials fill in pools downstream.

Over the last few years, hydrologists regularly have measured the movement of bedloads. They want to discover how much of the total sediment load in streams consists of bedload. They also want to tie their bedload data to the information biologists have been gathering related to fish habitats on stream bottoms.

On an annual load basis in most streams, bedload makes up less than 20% of the total sediment load. Streams transport the remaining 80% or more as suspended load. An important consideration is that bedload may move only a few days each year — when stream velocities are highest (that is, it moves in surges during high flows). The stream then stores the bedload on the stream bottom until the next large event (such as a period of heavy spring runoff).

Streams with large accumulations of stored sediment or unstable banks are apt to have significant bedload movements. If researchers identified a trend of increasing bedload movement, it would imply a decrease in water quality. Fish eggs, for example, might not be able to survive such movements, and the whole aquatic ecosystem might suffer.

WATER CHEMISTRY

Much of the surface water flowing in the Flathead River Basin has spent some time underground. The often-times different chemical composition of ground water influences the quality of surface water. Bedrock influences water quality because the groundwater dissolves the minerals of the bedrock. Some waters in the Flathead River Basin have naturally moderate amounts of dissolved constituents because they flow through limestone. Those waters flowing through quartzites and argillites have naturally low amounts of dissolved constituents.

Most of the water chemistry data show that water in the basin is suitable for all designated uses (such as for cold-water aquatic life, public water supplies, recreation, irrigation, and industrial uses). There is wide seasonal fluctuation of some constituents, however. For example, in the spring, large quantities of melted snow enter streams. This snowmelt dilutes calcium bicarbonate and other dissolved minerals in the surface waters. Such snowmelt has not had much time to dissolve minerals from the soils and rocks before entering the stream. Therefore it also lowers the specific conductance, hardness, and alkalinity (buffering capacity for neutralizing acids) of the surface water.

Nutrients, metals, and pesticides may be attached to the smallest sediment particles in streams. The more nutrients dissolved in a body of water, the more plant and animal life the water can usually support. Contrary as it may seem, an over-abundance of certain plant and animal life signifies a decrease in water quality. Highly productive waters contain large crops of plants, large amounts of decaying matter, large numbers of bacteria, and low dissolved oxygen. As water clarity decreases, noxious plants may flourish, and "rough" fish (those tolerant of warmer waters and less oxygen) may predominate. Also, the water may taste and smell bad.

Researchers focus their attention on the amounts of phosphorus and nitrogen in the Flathead River Basin. These nutrients usually limit the growth of plants. When phosphorus or nitrogen levels increase (everything else remaining constant), more plant growth usually occurs. Increased plant growth decreases water clarity, which signifies a decrease in water quality.

Researchers believe the primary sources of phosphorus are decomposed organic matter (sewage), phosphorus compounds stored on sediments, and phosphorus that falls from the air combined with precipitation and dust. Concentrations of phosphorus increase as water flow increases. This indicates a surface source of phosphorus rather than a groundwater source (since groundwater flows remain fairly uniform at peak stream flows).

Phosphorus concentrations generally show significant positive correlation with water discharge and suspended sediments. That is, if there is more water flowing, suspended sediment concentrations will increase; and as the concentrations of suspended sediment increase, so will the concentrations of phosphorus (which is attached to the sediment particles).

Researchers found strong positive correlations between phosphorus concentrations and stream discharge at the streams evaluated (Whale, Coal, Big, and Krause Creeks). They found similar correlations between phosphorus and suspended sediment loads. However, nutrient levels remain low in Flathead National Forest streams.

Chicken Creek's average annual total phosphate as phosphorus yield in pounds per square mile over the period of record (1982-1991) was higher than the average annual total phosphate as phosphorus yields of the West and East Forks of Swift Creek. (See Figure 8.) Since Chicken Creek is a baseline station and the West and East Forks of Swift Creek have been logged, researchers have not found a significant statistical relationship between phosphorus concentration and forest development in the Swift Creek drainage of the Stillwater State Forest.

Researchers often classify lakes on a continuum from oligotrophic to eutrophic. Oligotrophic lakes are usually deep, have a good oxygen supply, cold water, and low plant and animal productivity. Eutrophic lakes have abundant nutrients, a decreased oxygen supply, warmer water, and high plant and animal productivity.

Whitefish Lake is oligomesotrophic. That means that it is on the threshold of change from slightly enriched to moderately enriched. Researchers have concluded that adding additional nutrients to the lake will further stimulate algal productivity.

Swift Creek supplies water to Whitefish Lake. Over the period from 1982 through 1991, Lower Swift Creek (as measured at Crain's Ranch) had an average annual yield of 36 pounds of phosphate as phosphorus per square mile. (See Figure 8.) This annual yield was over four times higher than the average annual yield measured in the same vicinity at Lazy Creek.

The data for Lower Swift Creek indicate that reactive phosphate as phosphorus makes up only about 12% of the total annual phosphate as phosphorus yield. (Reactive phosphorus is a form of phosphorus that is available for plant growth.)

To prevent eutrophication of lakes and reservoirs, the Environmental Protection Agency recommends that total phosphate as phosphorus should not exceed 0.025 mg/L. They also recommend an upper limit of 0.050 mg/L total phosphate as phosphorus for all streams entering lakes or reservoirs.

Total phosphate as phosphorus in Lower Swift

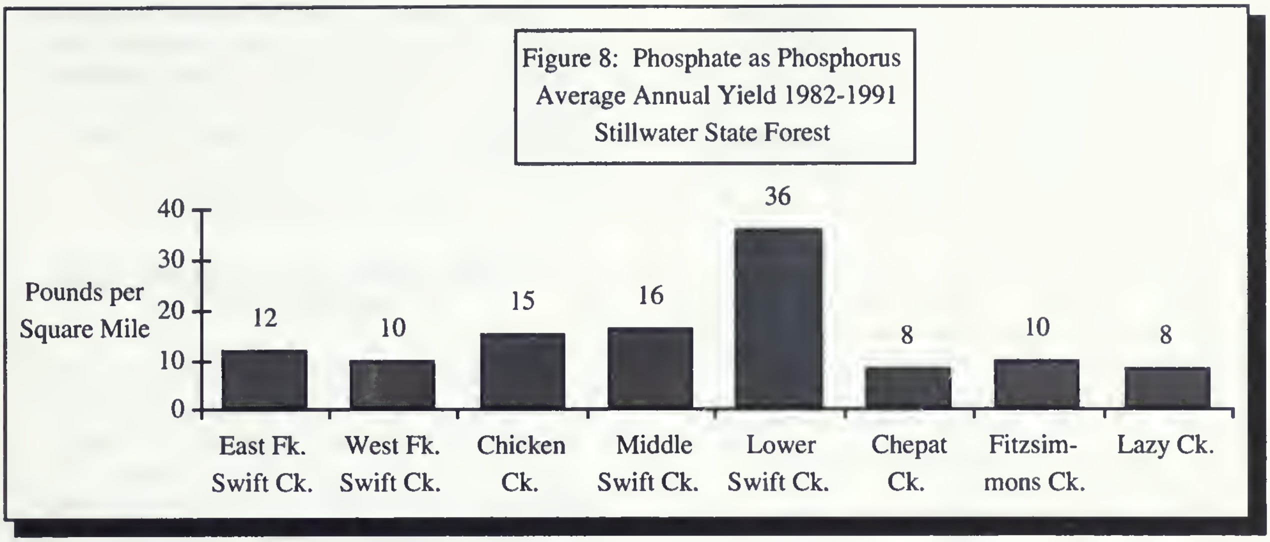


Figure 8: Phosphate as Phosphorus Average Annual Yield 1982-1991 Stillwater State Forest

Creek exceeded the 0.050 mg/L recommendation in 8 samples (6 in 1991 and 2 in 1990). Total phosphate as phosphorus in the West Fork of Swift Creek exceeded the 0.050 mg/L recommendation once in a 1990 sample. All high phosphate as phosphorus levels coincided with the timing of spring runoff.

Lower Swift Creek had over a twofold increase in total phosphate as phosphorus yield when compared to Middle Swift Creek (Figure 8). For the 1990-1991 period, Lower Swift Creek was an order of magnitude greater in both total phosphate as phosphorus yield and concentration than Middle Swift Creek. Since no significant land management activities have occurred recently, researchers attribute the abnormally high phosphorus levels to natural geological processes such as sediment from the unstable stream banks between Middle Swift and Lower Swift. Any subtle changes that may have occurred as a direct result of management were masked by the sediment added to Swift Creek from its unstable channel banks.

Generally, nitrogen concentrations do not increase or decrease in a consistent manner when either discharge or suspended sediment yields increase or decrease. Researchers believe that this lack of correlation may be due to its high solubility. To prevent eutrophication of lakes and reservoirs, researchers recommend nitrate concentrations of less than 0.30 mg/L. The maximum nitrate concentration recorded was 0.21 milligrams per liter (in 1985). Most nitrate concentrations were less than one-tenth of that concentration.

Dissolved oxygen, pH, total alkalinity, and conductivity analyses all show seasonal variation due to snowmelt dilution and changes in temperature. These variations almost always remained within acceptable ranges for native fish and other uses. Summertime dissolved oxygen concentrations measured in some of the slow moving streams (such as Squaw Meadows Creek), were low, but not low enough to kill fish. The lowest dissolved oxygen observed was 6.2 mg/L. (The Montana water quality standard for dissolved oxygen is 7.0 mg/L.)

MICROBIOLOGY

As expected, researchers found low fecal coliform and fecal strep bacteria counts in the North, South, and Middle Forks of the Flathead River and in the Spotted Bear River. These counts were within standards for swimming and floating. However, the water in these rivers must be purified to be suitable for drinking. (This is not unusual. Most surface water world-wide must be purified before drinking because of naturally present but harmful organisms like *Giardia*.)

WATER QUALITY IN GLACIER NATIONAL PARK LAKES

To establish a water quality baseline for lakes in Glacier National Park, the National Park Service and the Flathead Lake Biological Station began a cooperative monitoring program in 1984. Researchers collected data every summer and fall through 1990. They monitored five large frontcountry lakes and eight remote backcountry lakes. They were primarily concerned about the relative sensitivity of the lakes in Glacier National Park to acid precipitation and whether such pollution had already begun.

Cobalt, Snyder, Upper Dutch, Gyrfalcon, and

Two Medicine Lakes (in order of increasing solute concentrations) all turned out to be very dilute systems. They have very little buffer capacity and will be very sensitive to acid precipitation. No trends from year to year were evident for solute data for these or any of the other lakes. This suggested that little, if any, episodic pollution was occurring.

Metals concentrations in all of the lakes were near detection limits, with the exception of aluminum, iron, and barium. However, the researchers concluded that nothing unnatural was occurring. Sulfates in all of the lakes were also near or below detection limits throughout the study period, and they concluded that no significant atmospheric deposition occurred.

Lakes in Glacier National Park in general contained very low phosphorus concentrations relative to nitrogen. Any abnormal input of nitrogen and phosphorus could immediately stimulate phytoplankton productivity and secondarily alter the food web of these lakes through the process of eutrophication.

The amount of dissolved organic carbon can also indicate the relative trophic state of lakes. The more phytoplankton production that occurs in response to nutrient loading, the more organic carbon should accumulate. The researchers concluded that the production of organic carbon is nutrient limited, much more so by phosphorus than by nitrogen, allowing nitrogen to accumulate naturally in the water.

One might expect more zooplankton in lakes containing higher crops of algae, but this was not the case for all of the lakes. No clear relationship between phytoplankton and zooplankton could be demonstrated across all lakes.

Lakes containing fish did not have many large zooplankters (that is, copepods and cladocerans), and the crops were dominated by small rotifers. On the other hand, large species of zooplankton, particularly the red-bodied *Hesperodiaptomus shoshone* were always present in the fishless lakes. Clearly, grazing by fish profoundly affects the pelagic food web. Very likely, the introduction of fish in alpine lakes in Glacier National Park has produced the most measurable effects in relation to other potential pollutants.

All of the lakes the researchers monitored were oligotrophic or ultraoligotrophic. In other words, they have extremely good water quality. Researchers observed no measurable pollutants in any of the lakes except for the effects attributed to introduced fishes.

On the basis of all information, the researchers concluded that water quality in these lakes was near pristine. The monitoring program clearly established a baseline from which future changes may be documented. Researchers should continuously monitor several of the lakes (Cobalt, Dutch, and Gyrfalcon). The others should be resampled periodically.

WATER QUALITY IN FLATHEAD LAKE AND ITS TRIBUTARIES

Data added to the water quality database since the last progress report (Flathead Basin Commission, 1991) have not substantially changed the long-term averages and ranges of water quality parameters for most sites monitored. Indeed, based on water chemistry data over the period from 1977 through 1992, water quality remains high in Flathead Lake and most of its tributaries.

Ashley Creek continues to be the most notable exception. This creek drains waste-water from the Kalispell Sewage Treatment Plant into Flathead Lake. It still contributes substantial loads of human-caused nutrients to the lake.

From 1977 through 1992, the Kalispell sewage treatment plant annually contributed 12 to 18 percent of the biologically active phosphorus that reached the lake. (See Figure 9.) For example, over the 16-year period, water from Ashley Creek contained an average of 296.3 micrograms of soluble reactive phosphorus per liter of water. If Ashley Creek were in a pristine condition, one would expect it to have nutrient concentrations similar to other Flathead River Basin streams. As a comparison, water from the Swan River contained an average of only 1.2 micrograms of soluble reactive phosphorus per liter. Ashley Creek contained 247 times more phosphorus per liter than the Swan River. This significant difference implies that a substantial amount of Ashley Creek's nutrient concentration came from human-related sources (for example, the Kalispell sewage treatment plant).

However, total phosphorus concentrations (and hence unit volume load) in Ashley Creek are clearly declining as a result of modernization of the Kalispell sewage treatment plant. This speaks well for the nutrient reduction programs of the Flathead Basin Commission and the Water Quality Bureau. Nitrogen continues to be a problem. Improvements in the Kalispell sewage treatment plant should reduce the nitrogen load from the plant. Nonetheless, Ashley Creek continues to be a major pollution source.

Figure 9: Soluble Reactive Phosphorus and Soluble Nitrate Variables
Average Concentrations, 1977-1992
Flathead Lake

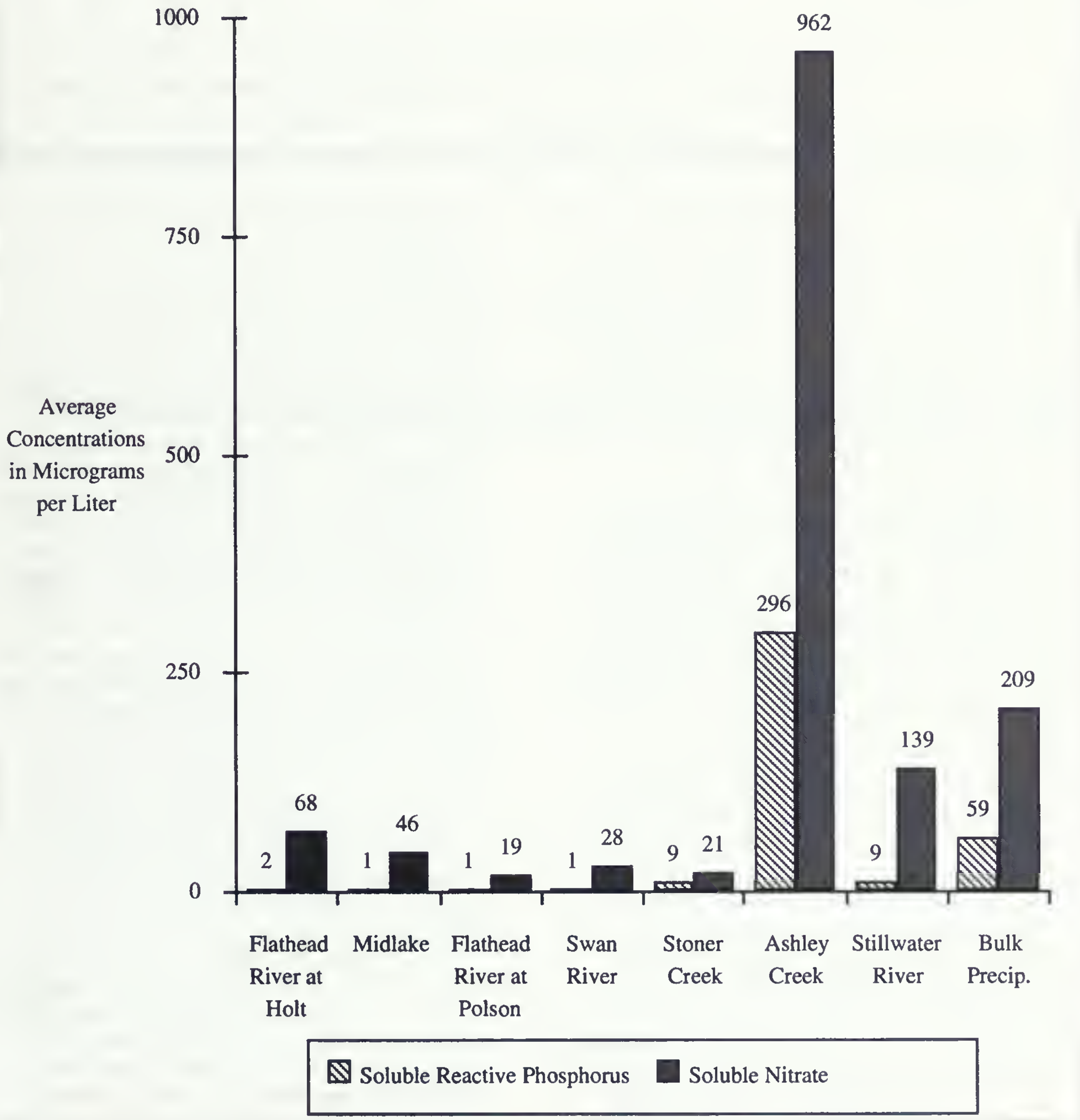
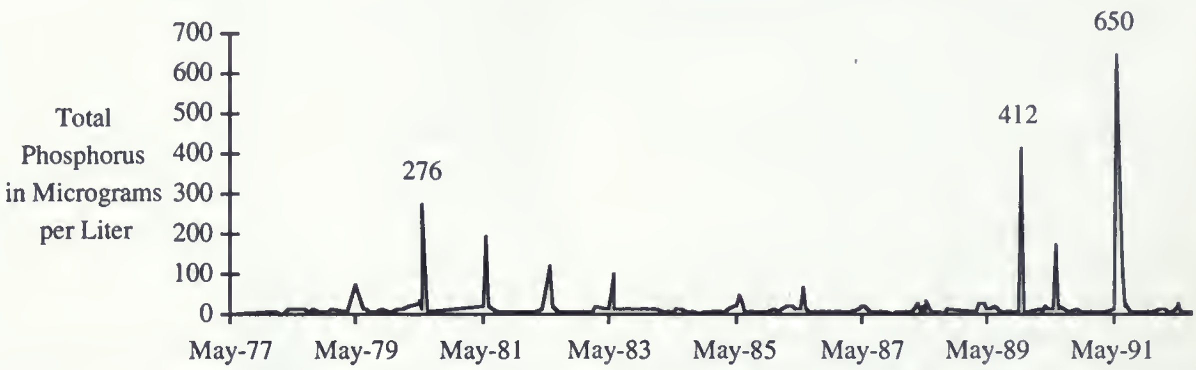


Figure 10: Time-Series Plot of Total Phosphorus Measured in the Flathead River near Holt



Concentrations of nitrogen and phosphorus have been comparatively high in Stoner Creek, also. In the past, researchers have assumed the high nutrient concentrations in Stoner Creek came from the leaching of septic tank drain fields around the town of Lakeside. Researchers expected that the new Lakeside sewage system (completed in 1989) would reduce the nutrient loads carried by Stoner Creek. However, there is little evidence of that in the database.

Researchers recognize the need to examine thoroughly nutrient data in terms of load rather than concentration. This task requires accurate streamflow data for all tributaries that contribute water to the lake. The U.S. Geological Survey gauges the discharge of Flathead Lake's major tributaries. However, no one has maintained long-term records on discharge for shoreline tributaries (such as Stoner Creek). Without time-series discharge data, researchers cannot allocate nutrient loads reaching Flathead Lake.

Over the last five years, researchers measured discharges in Ashley Creek and Stoner Creek. They wanted to develop a relationship between the creeks' flow patterns and the flow patterns of those sites where long-term records already existed. These records will eventually allow researchers to more accurately estimate the loads of soluble materials being discharged from Ashley Creek and Stoner Creek into Flathead Lake. Effects of the winter drought and low spring runoff in 1992 were clearly evident in both creeks.

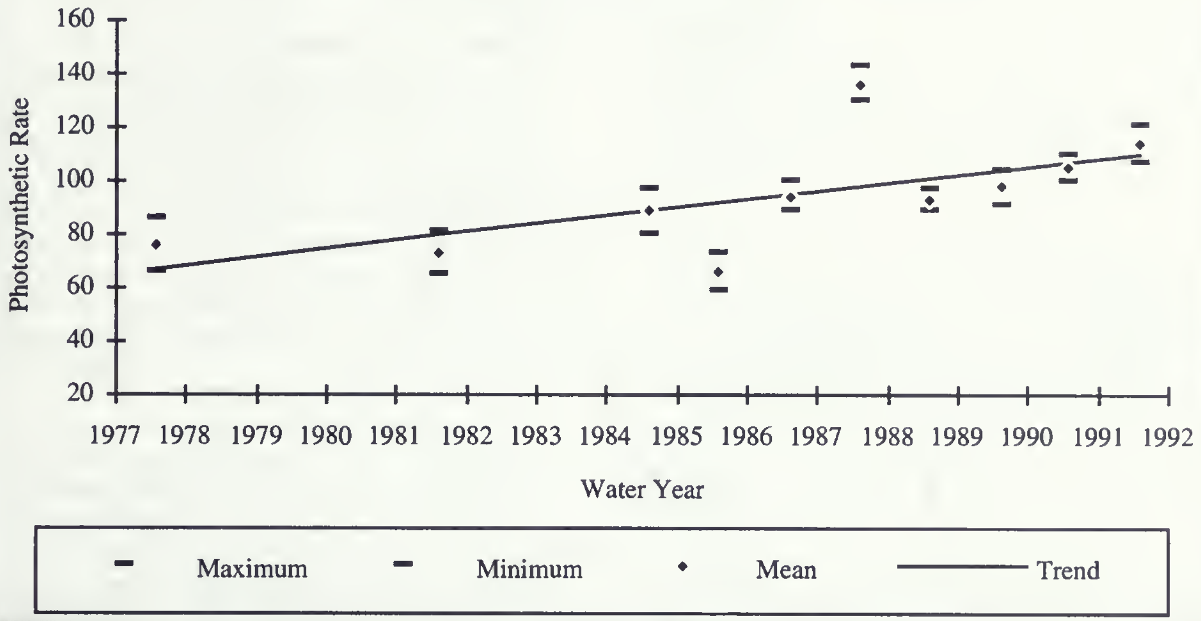
The air above Flathead Lake also continued to contribute substantial loads of nutrients into the lake. Most of these nutrients are apparently derived from human activities. Rain, snow, and dust annually dropped 23 to 38 percent of Flathead Lake's total biologically active phosphorus load directly onto the surface of the lake. Bulk precipitation samples taken immediately after periods of air stagnation routinely contained phosphorus concentrations about one to three orders of magnitude higher than samples taken after periods of thorough air circulation. Wood smoke often pollutes the air in the Flathead River Basin. Particulates from wood smoke seem to contribute substantially to the higher phosphorus load measured in the bulk precipitation samples during air stagnation. These sources of nutrients may maintain the lake near a critical threshold beyond which water quality may deteriorate suddenly (for example, through widespread blue-green algae blooms).

Researchers have found no discernible long-term patterns in the chemical environment of Flathead Lake. However, seasonal changes occur. For example, nutrient loads increase dramatically in direct association with spring runoff. (See Figure 10.) During late summer, aquatic plants, particularly phytoplankton, in the water column assimilate nitrate in surface waters. Kerr Dam also removes water off the surface of Flathead Lake. These events deplete nitrate from the upper layers of Flathead Lake.

Chlorophyll concentrations and rates of phytoplankton growth routinely increase during the spring and early summer. This occurs because light, nutrients, and the temperature regime favor increased production. Indeed, analysis of the database shows a relatively good relationship between primary production and chlorophyll concentration.

Researchers at the Flathead Lake Biological

Figure 11: Annual Primary Production in the Water Column of Flathead Lake
1977-1992 Water Years



Station also have observed a long-term increase in primary production (that is, the propensity of the lake to grow algae) within the water column of Flathead Lake. (See Figure 11.) The trend is statistically significant and suggests that algae and other microorganisms in the lake are being fertilized by excess nutrients from the drainage basin and from polluted precipitation that falls on the lake surface. Further monitoring data and analyses are needed to firmly determine cause and effect in these time-series primary production data. However, the implications are clear — water quality is declining.

For the first time since limnological studies began on Flathead Lake in 1896, researchers have observed the reduction of dissolved oxygen in the bottom layers of the lake (the hypolimnion) during the summer period of thermal stratification. Hypolimnetic oxygen reduction is a sure sign of cultural eutrophication (that is, lake enrichment from nutrient pollution). Researchers have observed the same phenomenon in Swan and Whitefish Lakes, but they are not sure if it has occurred in the past. In Flathead Lake, however, researchers are certain that the reduction is a new event. Researchers observed this hypolimnetic oxygen reduction only in Big Arm Bay (Ross Deep).

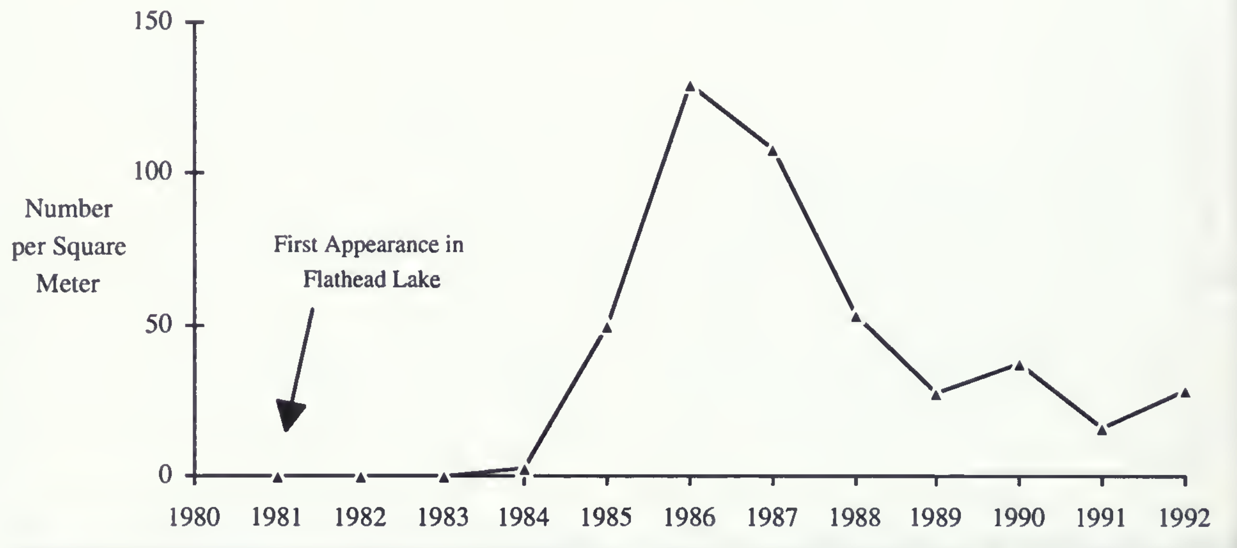
There is a need for researchers to carefully monitor hypolimnetic oxygen levels and to immediately analyze what is known about nutrient loading from catchment and shoreline sources. For example, the overflow plume of the nutrient rich spring runoff event may be entrained in Big Arm Bay, and there are significant sources of shoreline pollutants in that area of the lake (for example, septic fields and agricultural practices).

Mysis relicta (opossum shrimp) first appeared in Flathead Lake in 1981. (See Figure 12.) Their presence in the lake may affect the chemical environment and primary productivity dynamics, but this has not been substantiated.

However, the population dynamics of *Mysis* shrimp in Flathead Lake present a classical case for a newly invading predator. They have destabilized the food web and drastically changed the abundance of other consumer groups. Following their initial appearance, densities of *Mysis* shrimp increased exponentially. They reached a maximum density of 129 shrimp per square meter in 1986. (See Figure 12.)

Mysis shrimp prey mainly on crustacean zooplankton. *Mysis* shrimp prefer cladoceran zooplankton,

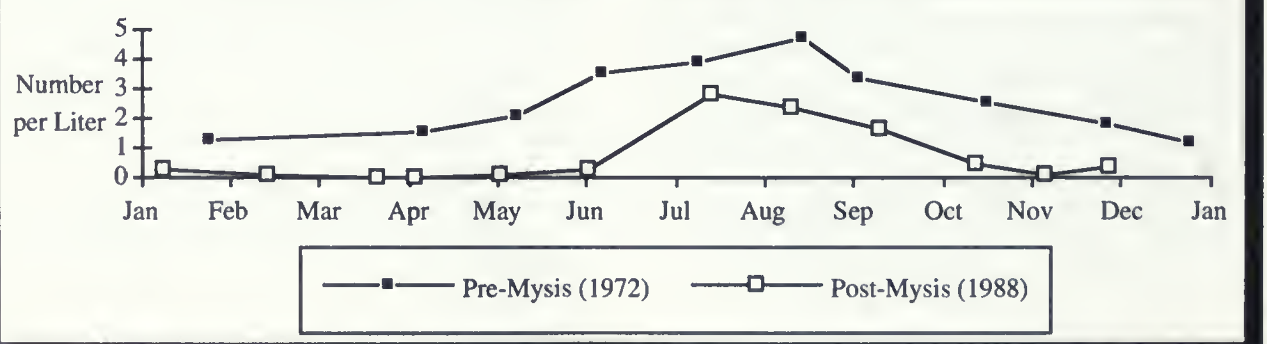
Figure 12: Mysis shrimp in Flathead Lake based on an average of 15 or more vertical nocturnal tows at different sites 1980-1992



especially *daphnia* species (water fleas). As the density of *Mysis* shrimp increased, the density of cladocerans declined dramatically. (See Figure 13.) Since 1986, the Mysis shrimp population has steadily declined and stabilized. This decline in abundance appears to have been a density-dependent response. *Mysis* shrimp depleted the stock of their zooplankton prey and more fish ate the *Mysis* shrimp. Several fish species (including lake whitefish and young lake trout) feed on *Mysis* shrimp. The density of these fish increased so dramatically in Flathead Lake that the Montana Department of Fish, Wildlife and Parks and the Confederated Salish and Kootenai Tribes initiated harvest regulations in 1991 designed to reduce their numbers.

The mean density of *Mysis* shrimp in 1992 was 28.6 shrimp per square meter. This was higher than the 1991 mean density of 16.1 shrimp per square meter (the lowest density since 1984). Researchers think that

Figure 13: Mean daytime densities of water fleas (cladocerans) at Flathead Lake's Midlake Sampling Station estimated by summing 10 meter vertical hauls from 50-40 meter, 40-30 meter, etc., to the surface



the density of *Mysis* shrimp will continue to oscillate in the range of the 1989-92 data as long as the food web remains the same. If another exotic species is introduced into the lake or if anglers over-harvest one of the sport fishes, *Mysis* shrimp densities may fluctuate dramatically again.

Several cladoceran species (such as *Leptodora kindtii* and *Daphnia longiremis*) disappeared from sample collections during 1985 through 1987. They reappeared in samples collected in 1989, but the density of cladocerans was lower in 1991 than in previous years, suggesting that the cladocerans in Flathead Lake will not likely rebound in the near future to pre-*Mysis* shrimp densities. However, the total zooplankton populations should oscillate around their 1989-92 levels and in relation to the density of *Mysis* shrimp.

Mysis shrimp are cold-water organisms. From November through June, they prey on zooplankton throughout the entire water column. From July through September, Flathead Lake becomes thermally stratified, and surface waters reach temperatures of more than 15° C (59° F). *Mysis* shrimp remain in the cooler waters below the thermocline (the zone of rapid water temperature change). This creates a refuge for zooplankton above the *Mysis* shrimp. Researchers only find significant numbers of cladocerans during these warm summer months.

Before the introduction of *Mysis* shrimp, *Daphnia longiremis* (a water flea species) had been abundant. They lived in the deeper, colder parts of Flathead Lake. However, researchers found *Daphnia longiremis* only once in samples taken from 1988 to the present. Since *Mysis* shrimp also favor the colder, deeper water, researchers think the *Mysis* shrimp probably decimated the *Daphnia longiremis* population.

Volunteer Monitoring Program

The Flathead Basin Commission recently began a program to train volunteers how to monitor water quality. These volunteers have been collecting data from various lakes in the basin, including several sites on Flathead Lake. Their efforts provide useful information to supplement the data collected by various agencies.

LOWER FLATHEAD RIVER BASIN/ FLATHEAD INDIAN RESERVATION

The Lower Flathead River Basin is that portion of the watershed from the outlet of Flathead Lake at Polson to the confluence of the Flathead and Clark Fork Rivers near Paradise, Montana. (See Figure 1B.) This area is contained almost entirely within the boundaries of the Flathead Indian Reservation. The Confederated Salish and Kootenai Tribes' Natural Resources Department is responsible for water quality monitoring on the Reservation (which also includes the south half of Flathead Lake). The Tribal Water Quality Program implemented a Reservation-wide surface water quality monitoring program on November 16, 1992.

Researchers are monitoring the following major tributaries to the Lower Flathead River: the Little Bitterroot River, Crow Creek, Mission Creek, and the Jocko River. The drainage areas of these watersheds include approximately 80 percent of the Reservation land area. By monitoring upstream and downstream locations on these streams, researchers will be able to determine trends and impacts of sediment and nutrient pollution within each watershed.

The streams monitored deliver large volumes of sediment to the Lower Flathead River. Normally there is a direct relationship between increases in sediment loads and discharge. However, the data collected do not support this assumption, particularly in the case of Mission Creek. Mission Creek shows a wide range of sediment loads within a relatively narrow range of discharges. (See Figure 14.) The relationship between discharge and suspended solids (sediment) in these watersheds is weak. Since these watersheds represent a large area, and since there is a direct relationship between sediment and nutrient concentrations, it is readily apparent that the Reservation has some serious nonpoint source water quality problems.

The Tribal monitoring program also includes three tributaries to Flathead Lake — Dayton, Blue Bay, and Hellroaring Creeks. The data collected from these watersheds will help researchers determine the effects activities such as timber harvesting, irrigated agriculture, and commercial and residential expansion have on lake water quality.

The Tribal Water Quality Program continues to move forward to protect, preserve, and enhance the Reservation environment in cooperation with the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers.

The Confederated Salish and Kootenai Tribes are very concerned with water quality conditions in the entire Flathead River Basin. Aboriginal hunting and

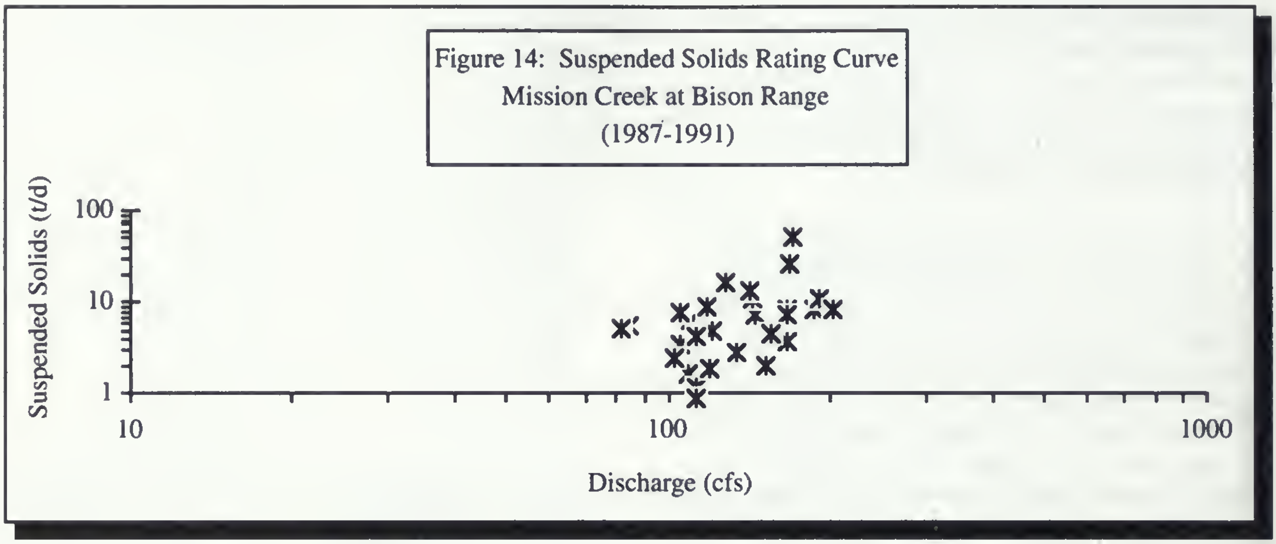


Figure 14: Suspended Solids Rating Curve
Mission Creek at Bison Range
(1987-1991)

fishing rights require that cultural, wildlife, and fisheries resources of the basin be protected in perpetuity. The Tribes support the Flathead Basin Commission in its efforts to coordinate water quality management within the basin.

FISHERIES

Fish Habitat Quality

Westslope cutthroat and bull trout bury their eggs in the gravels of streambeds. The embryos need dissolved oxygen to survive, and they obtain it from water circulating through the gravel. Water must also circulate around the eggs to remove metabolic wastes. If the gravel contains too much sediment, the water cannot circulate effectively. Without oxygen, the fish eggs die. Also, newly hatched fish can be trapped in the sediments of a streambed and die.

Because of its effect on the development of fish embryos, the concentration of fine materials (sediments) in stream bottoms is a key indicator of fish habitat quality. Streambed gravels containing large amounts of materials with diameters of less than one-fourth inch can reduce the survival rate of fish eggs. Such materials are generated naturally and by land-use activities such as timber harvest and forest road construction.

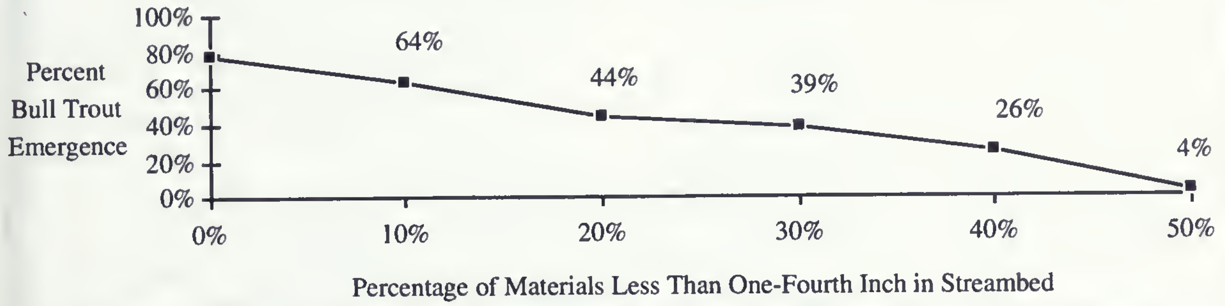
As the percentage of fine materials in a streambed increases, fewer bull trout fry emerge from nests in the gravel. (See Figure 15.) The relationship between the percentage of fine materials in a streambed and the emergence success of westslope cutthroat fry is similar to that for bull trout fry. Over the years, predicted embryo survival in monitored streams has ranged from 21% to 33% for westslope cutthroat trout and from 24% to 37% for bull trout.

Researchers monitor the percentage of fine materials in the stream-bottom gravels of important streams used by spawning bull trout and cutthroat trout. In the North Fork Flathead River drainage, researchers core sampled bull trout spawning areas in Coal Creek, Big Creek, Whale Creek, and Trail Creek.

Drought conditions and accompanying low stream flows throughout the ice-free season from 1985 through 1988 affected most spawning tributaries by increasing the amount of fine sediments deposited. By comparison, streamflows from 1989 through 1991 were generally near normal. In 1991, fine sediment levels decreased from 1989 levels in Big Creek and main Coal Creek, apparently as a result of spring flushing flows. A localized storm which generated high flows during May, 1991 (as determined by Flathead National Forest hydrologists) may have caused the reduction of sediment levels in lower Big Creek. However sediment supplies stored behind debris dams remain high in the upper Big Creek basin.

In the South Fork of Coal Creek, researchers have noted no significant changes in fine materials since 1986. No major land-disturbing activities have taken place in the South Fork of Coal Creek above the sampling site since researchers began collecting data in 1985. However, a large amount of material currently is deposited behind beaver dams in the South Fork of Coal Creek drainage. Much of the material stored behind the beaver dams originated from harvest

Figure 15: Bull Trout Emergence
Relationship between percentage of fine materials and emergence success of bull trout from gravels in Coal Creek, North Fork of Flathead River drainage, 1990



activities in the 1950s. When the dams eventually fail, this fine material will likely impact spawning gravel downstream.

In the North Fork of Coal Creek, researchers have found the percentage of fine materials to be variable since 1985. They observed a significant decrease between 1989 and 1990 but no change since that time. Timber was recently harvested in the North Fork of Coal Creek above the sampling site. Researchers have noted considerable natural erosion and slumping in the headwaters area (especially when compared to the upper South Fork of Coal Creek). Researchers also noted several other sources of sediment caused by past forest management. Since then, U.S. Forest Service employees have initiated efforts to help stabilize several of the identified problem areas.

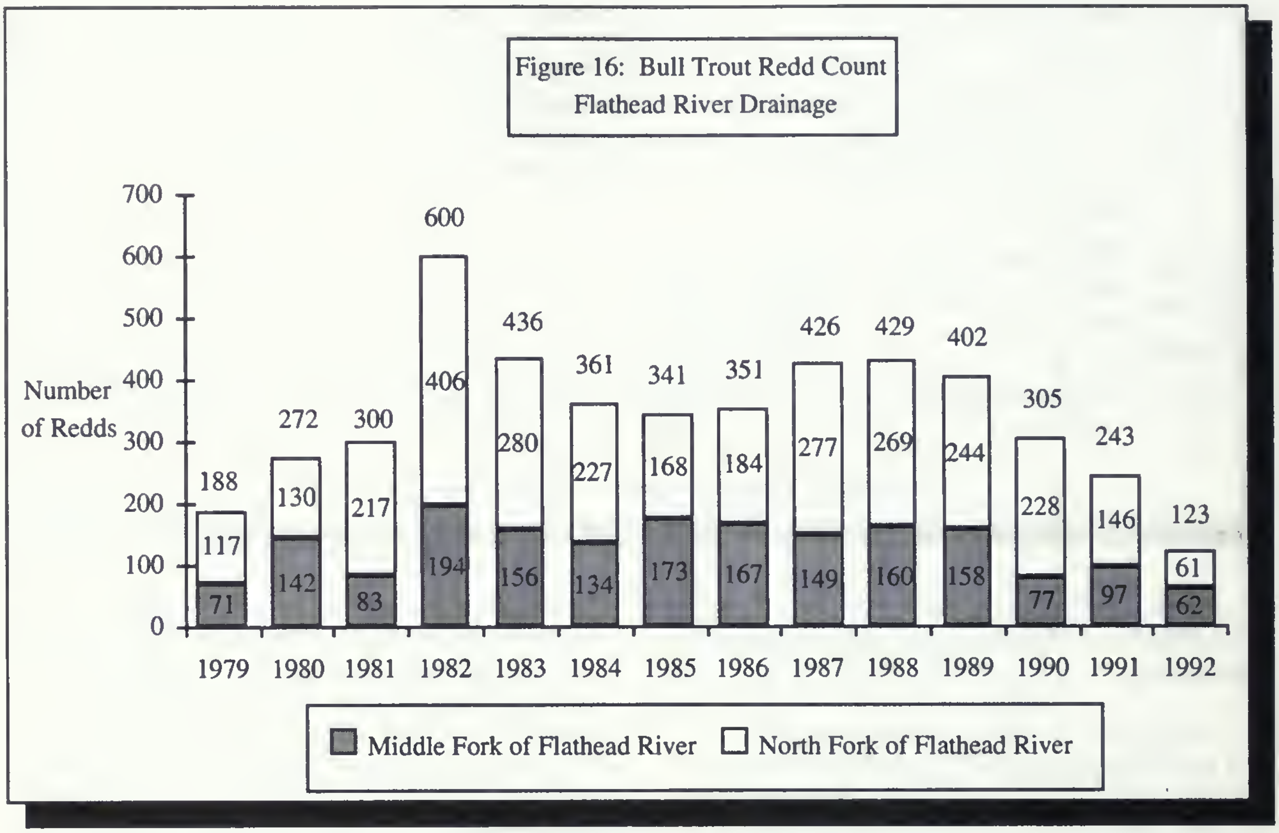
In general, the results from monitoring the concentration of fine materials in streams do not indicate a direct effect from current management activities, but do suggest the likelihood of cumulative effects from past activities in some drainages. Natural stream variation continues to complicate the interpretation of monitoring results and the erratic downstream transport of sediment stored behind log debris precludes predictions of annual changes. Nevertheless, the monitoring information helps researchers describe existing conditions, identify levels of risk, and evaluate changes in fish populations. Researchers need to continue monitoring gravel conditions in these key bull trout creeks over a long period of time to try to separate the effects of natural events from forest practices.

It is also important to measure the degree to which individual rocks are imbedded in the stream bed. "Embeddedness" is a measure related to the rearing space for young trout and their insect prey. Young bull trout need to have hiding places under and between clean rocks on stream bottoms. Researchers have monitored rearing habitat at important sites using an index known as the substrate score (a combined ranking of streambed particle size and embeddedness). A substrate score greater than 11 indicates good rearing habitat for juvenile fish. Scores of less than 9 indicate marginal habitat. Substrate scores at all sites from 1983 to 1991 measured above 9. During 1991, values observed varied only slightly from the previous year.

Researchers found that substrate scores generally reflect the same trends observed in the coring data. That is, as spawning gravel quality declines, so do substrate scores and juvenile fish populations. Researchers should continue monitoring substrate scores. The agencies responsible should expand the area covered to include all major bull trout spawning streams.

Fish Populations

Bull trout and cutthroat trout are particularly sensitive to environmental disturbances. Juvenile bull trout live very close to or in the bottom materials of rearing streams. Westslope cutthroat trout typically occupy positions higher up in the water column. Changes in streambed materials more strongly affect bull trout. Trout populations also fluctuate due to natural factors. Regardless of these natural variations,



trout are still excellent indicators of in-stream environmental quality. Researchers monitor fish populations in streams by counting redds (spawning nests) or by electrofishing in a specific stream section. They sample the fish in lakes using capture nets and sonar equipment.

BULL TROUT

Most adult bull trout live in lakes and migrate into tributaries to spawn. Researchers find it easier to survey the spawning runs of bull trout (which occur in September during low streamflow) than the spawning runs of westslope cutthroat trout (which occur during spring runoff). Both types of trout have similar needs in terms of spawning gravel.

The number of bull trout redds at sites in the North and Middle Fork drainages of the Flathead River is an indication of the number of adult spawners migrating from Flathead Lake. The eight index tributaries surveyed contained over 400 redds in 1987, 1988, and 1989. The number of redds decreased to 305 in 1990 then to 243 in 1991. The 1992 count of 123 is the lowest on record. (See Figure 16.) Over the last 14 years, researchers have found an average of 357 redds annually. The 1991 redd count of 243 was 34 percent less than the 13-year average, and the 1992 count of 123 was 65 percent less.

Field crews conducted basin-wide bull trout redd counts in 1980, 1981, 1982, 1986, 1991, and 1992. The 1991 basin-wide redd count of 516 was lower than the counts for all previous years except 1980, which may have been low (462 redds) because of incomplete surveys. Most alarmingly, the 1992 basin-wide count of 222 is considerably lower than all other years.

There may have been fewer redds in recent years because of such things as: lake trout preying on young bull trout in Flathead Lake and the lower Flathead River System; increased competition for food and space due to changes in the food web of Flathead Lake; thermal effects of water releases from Hungry Horse Dam; effects of drought conditions in recent years; habitat degradation in tributary streams; or overharvest by anglers.

From previous redd counts, researchers had estimated that each year about 3,450 bull trout spawned successfully in the Flathead River drainage. Their 1991 estimate of 2,375 spawners is 31 percent less than the average for previous years. The 1992 estimate of 975 spawners is 72 percent below average.

Swan Lake supports a denser population of adult bull trout than Flathead Lake. Researchers have annually surveyed four tributaries in the Swan River drainage since 1982. In the period from 1985 through 1989, the number of redds in these tributaries steadily increased from 109 to 371. In 1990, the number of redds decreased to 263, but in 1991 they increased to 366. The 1992 count of 375 redds is the highest observed to date.

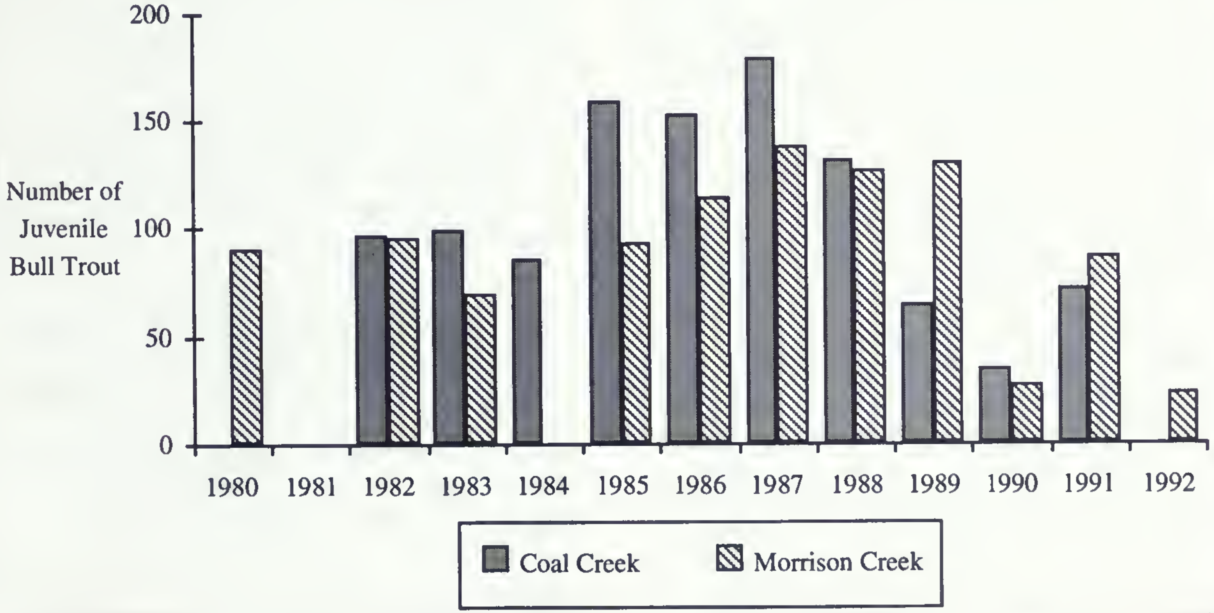
During the basin-wide count in 1992, field crews found 463 redds in the Swan River drainage. From that count, researchers estimated that 2,000 adult bull trout from Swan Lake successfully spawned in Swan River tributaries during 1992.

Researchers have identified Morrison Creek in the Middle Fork drainage and main Coal Creek in the North Fork drainage as two key index streams for monitoring juvenile bull trout. In recent years, juvenile bull trout populations have declined to their lowest levels in both of these streams. The decreased number of juvenile bull trout in Morrison Creek corresponded with the reduced substrate score from this stream. Apparently, channel changes and the decrease in usable habitat has affected juvenile bull trout production. It is also possible that the unusual fall flooding in 1989 stimulated earlier downstream migration of a portion of the juvenile bull trout population. (See Figure 17.) In main Coal Creek the number of juvenile bull trout at Deadhorse Creek Bridge has also decreased along with the substrate scores for the section.

Since 1989, researchers have found that the number of juvenile bull trout in the North Fork of Coal Creek has decreased dramatically. In 1992, the population reached the lowest point since sampling began in 1982. They believe the decreased numbers could have resulted from (1) high incubation mortality caused by the dewatering and freezing of redds; (2) reduced embryo survival to emergence due to a significant increase in the percentage of fine material between 1987 and 1988 and relatively high sediment levels through 1989; (3) destruction of bull trout eggs in the gravel from extensive bedload movement caused by a rain-on-snow event during early November of 1989; and/or (4) other habitat degradation as reflected in declining substrate scores.

The number of juvenile bull trout in both the North and South Forks of Coal Creek have fluctuated widely (by up to 400%) during the period of record

Figure 17: Bull Trout Juveniles
Numbers of young bull trout per 492 feet of stream channel in Coal and Morrison Creeks



(1982-1992). One factor that may be influencing the more frequent fluctuations in populations may be the unstable channel at the South Fork Coal Creek site. Drought-related effects seem to be more prevalent at the North Fork Coal Creek site.

The declines in juvenile bull trout abundance at certain sites is an ongoing concern. Management activities should be restricted to those which do not increase sediment loads, particularly in Big and Coal Creeks.

In 1985, the Confederated Salish and Kootenai Tribes closed the Lower Flathead River drainage to bull trout harvest. Tribal researchers have monitored four tributaries to the Lower Flathead River annually to assess bull trout spawning. Since 1986, the number of redds has indicated a relatively stable trend in the bull trout spawning population. One tributary, however, has shown an increase in bull trout spawning activity.

In 1992, the Confederated Salish and Kootenai Tribes entered into a cooperative agreement with the U.S. Fish and Wildlife Service to improve the prey base and overall spawning conditions for bull trout in two of the monitored tributaries.

In October of 1992, several locally-based resource groups petitioned the U.S. Fish and Wildlife Service to consider the bull trout under the Endangered Species Act. The Montana Department of Fish, Wildlife and Parks instituted an emergency closure to bull trout fishing in the Flathead River mainstem, North Fork, and Middle Fork in July of 1992 to protect the spawning run out of Flathead Lake. In December of 1992, this closure was extended through February of 1994 to all waters west of the Continental Divide with the exceptions of Swan Lake and Hungry Horse Reservoir.

Westslope Cutthroat Trout

Each year, researchers have counted the number of juvenile westslope cutthroat trout leaving Hungry Horse Creek bound for Hungry Horse Reservoir. During the period of record, they counted from 980 to 2,680 juvenile westslope cutthroat trout. Recently, the number of adult spawning westslope cutthroat trout in Hungry Horse Creek has declined. However, the number of juvenile westslope cutthroat trout leaving Hungry Horse Creek has not declined, suggesting that the population is not presently limited by reproduction.

The number and weight of juvenile westslope cutthroat trout fluctuated in most index streams during the period of record. Researchers have determined that fluctuations of 150 percent are common.

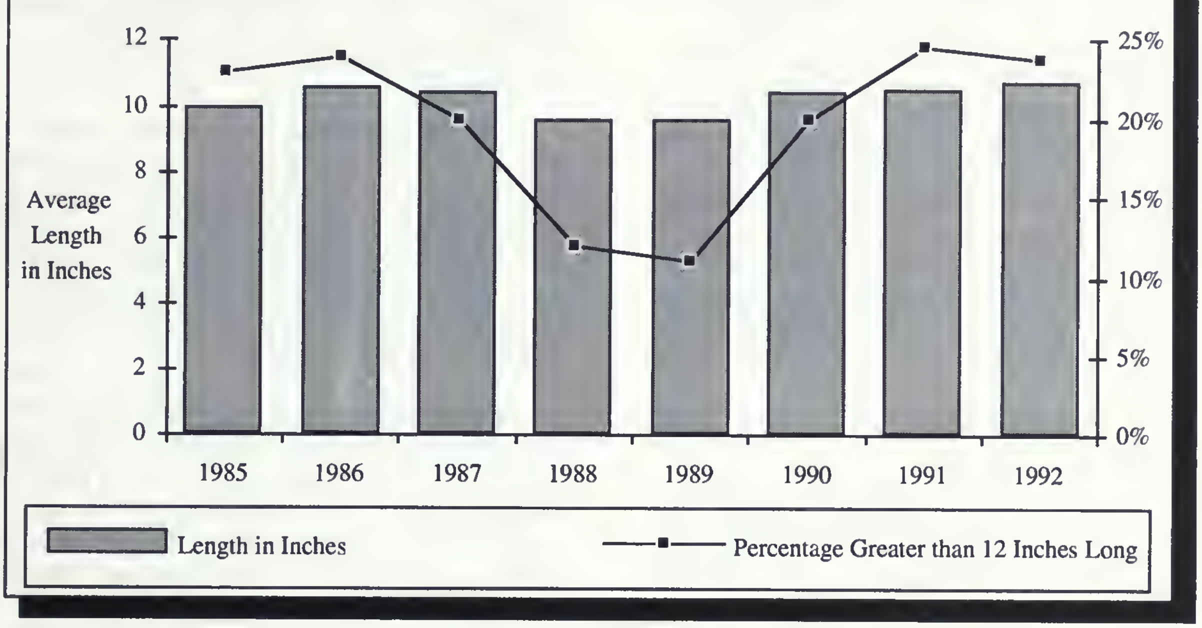
Westslope cutthroat trout are particularly vulnerable to angling. The Montana Department of Fish, Wildlife and Parks instituted restrictive regulations on the South Fork Drainage above Hungry Horse Dam in 1984. In 1985, researchers estimated that there were 952 westslope cutthroat trout per mile in a 3-mile section of the Upper South Fork of the Flathead River near Black Bear Creek. In 1989, they estimated there were 535 westslope cutthroat trout in that area. Researchers surveyed this section of the South Fork of the Flathead River again during the summer of 1992. At that time, their estimate was 732 westslope cutthroat trout per mile.

Researchers also monitor the size of westslope cutthroat trout. They found that in the South Fork of the Flathead River near Young's Creek, the average length is about ten inches. The percentage of westslope cutthroat trout greater than 12 inches long ranged from about 11 percent in 1989 to 25 percent in 1991. (See Figure 18.) The 1988 drought caused the decline in the average length of the fish and in the percentage of larger fish during 1988 and 1989. Genetic tests made in 1989 showed these fish to be pure westslope cutthroat trout.

In general, the number of westslope cutthroat trout in the South Fork drainage seems to be relatively stable. Apparently, the present regulation of 3 fish, none over 12 inches, is protecting the trout population in the upper South Fork. However, in other parts of the Flathead Basin they face continuing competitive pressure from non-native species (such as brook trout and rainbow trout) and increasing angling pressure. For this species to survive in the long run, managers must provide healthy riparian zones, avoid increasing the sediment in streams, and protect the species from over-harvest.

Throughout the Flathead River drainage, researchers have concentrated on identifying those areas where genetically pure populations of westslope cutthroat trout can still be found. Since 1984, this has been an ongoing effort with the University of Montana's Wild Trout and Salmon Genetics Laboratory. Therefore, land managers should give special consideration to these identified populations.

Figure 18: Average Length and Percentage of Westslope Cutthroat Greater than 12 inches in the South Fork of the Flathead River near Youngs Creek



KOKANEE SALMON

Researchers have determined that the decline of kokanee salmon in the Flathead System is related to competition with *Mysis* shrimp, predation, the operations of Kerr and Hungry Horse Dams, and other factors. Researchers monitored densities of juvenile and adult *Mysis* shrimp in Swan, Ashley, and Whitefish lakes from 1983 to 1990. They found between 20 and 252 *Mysis* shrimp per square meter of lake surface. Kokanee salmon virtually disappeared in Whitefish Lake after the *Mysis* shrimp became established. However, despite relatively high *Mysis* shrimp densities, kokanee salmon have persisted in Swan and Ashley Lakes. Over the period from 1987 through 1990 in Swan Lake, researchers counted increasing numbers of kokanee redds (spawning nests) in shoreline areas of Swan Lake. In 1987 they counted 1,885 kokanee redds, in 1988 they counted 1,555, in 1989 they counted 1,941, and in 1990 they counted 1,347. Ice along the shoreline in Swan Lake prevented kokanee redd counts in 1991. Kokanee salmon and *Mysis* shrimp seem to coexist well in the absence of lake trout and lake whitefish.

The number of kokanee salmon in Flathead Lake and Flathead River has decreased dramatically. In 1990 and 1991 surveys, researchers could not find any redds in McDonald Creek, in several mainstem Flathead River sites near Columbia Falls, or in several Flathead lakeshore sites.

The Montana Department of Fish, Wildlife and Parks and the Salish and Kootenai Tribes are engaged in an experimental kokanee salmon recovery program. Several million fry and fingerlings have been held until June and released in each of the last six years. Anglers have reported catching a few kokanee salmon. Also, researchers have found a few kokanee in the stomachs of lake trout. If the experimentally planted kokanee fry had survived to maturity, researchers expected that they would see spawning fish beginning in the fall of 1991. They did not observe any kokanee in the Flathead River during 1991. Anglers caught six kokanee near the South Fork confluence below Hungry Horse Dam in 1992. However, field crews could not locate any kokanee during two snorkel surveys in the Flathead River, during October and November of 1992. In the future, field crews will plant fish after they have grown for a year in a hatchery. Researchers believe that larger kokanee will have a better chance of escaping predators and surviving to maturity.

FLATHEAD LAKE

Researchers from the Montana Department of

Fish, Wildlife and Parks and from the Confederated Salish and Kootenai Tribes cooperatively monitor fish populations in Flathead Lake. In 1991, surveys indicated an average of 25.5 fish over one inch long per acre. This estimate is considerably lower than the 1989 estimate of 151.6 fish over one inch long per acre. The difference in estimates is due, in part, to changes in sampling techniques. After the 1991 sampling, researchers estimated that there were 2.8 million fish over one inch long in Flathead Lake. This estimate did not include fish species which reside in shallow, shoreline areas of the lake (that is, westslope cutthroat trout, yellow perch, peamouth, squawfish, and suckers). Also, the estimate did not include the South Bay of Flathead Lake. The estimate mainly included deeper-water species such as lake trout, bull trout, and lake whitefish.

Researchers determined the relative abundance of fish species in various areas of the lake using capture nets and trawls. They used these samples to confirm the sonar estimates. The dominant species in Flathead Lake was lake whitefish followed by lake trout.

The combination of dual-beam sonar sampling with confirmation netting and trawling is proving to be a valuable tool for monitoring the changing fish populations in Flathead Lake. Researchers will continue to use these techniques annually to monitor the fisheries. This will help them evaluate the success of Flathead Basin fisheries' improvement efforts under the mitigation plans for the Kerr and Hungry Horse dams which began in 1991.

Fisheries mitigation issues for both Kerr and Hungry Horse Dams are still active and have changed since the last *Biennial Report*. The Kerr Dam Mitigation Plan, filed by the Montana Power Company, addressed only fisheries concerns. Since its submittal in June of 1990, issues such as water levels and lakeshore erosion have arisen. As a result, the Federal Energy Regulatory Commission has delayed any action on the Plan to date pending input from the Department of the Interior, Bureau of Indian Affairs. The Northwest Power Planning Council passed fisheries mitigation measures for Hungry Horse Dam in November of 1991. This action provides funding for mitigation efforts as identified in an implementation plan which is currently being drafted.

EFFECTS OF HUNGRY HORSE RESERVOIR

Cold water releases from Hungry Horse Dam slow fish growth and affect insect production downstream. Discharges from the dam under present operation practices cause water temperatures to fluctuate up to 14° F in the Flathead River below the South Fork confluence. Researchers have shown that a rapid 4° F temperature change damages aquatic organisms. Field crews have detected thermal effects 40 river miles downstream at Holt Bridge near Flathead Lake.

The fluctuating water flows caused by power operations and the associated thermal effects greatly affect sediment transport, biological productivity, and nutrient cycling. To moderate these effects, a structure should be installed on Hungry Horse Dam to allow water releases from various depths in the reservoir. This would allow dam operators to control the temperatures in the water released.

Researchers have estimated that selective withdrawal would increase trout growth in the affected portion of the South Fork Flathead River by a factor of ten. Results also revealed that trout growth in the mainstem Flathead River would increase by 200 to 500 percent, depending on river flow conditions. Analyses conducted by the Montana Department of Fish, Wildlife and Parks have shown that selective withdrawal on all four penstocks at Hungry Horse Dam is the only way to achieve permanent and constant temperature control while allowing flexibility in the scheduling of power production.

The public supports selective withdrawal from Hungry Horse Dam. The Northwest Power Planning Council has directed that the Bonneville Power Administration and the Bureau of Reclamation take immediate action to construct the structure. However, the estimated $12.5 million (in 1991 dollars) needed to fund the project is currently unavailable.

Researchers at the Montana Department of Fish, Wildlife and Parks have expanded a computer model to assess the hydrological and biological effects of alternatives for operating dams in the Columbia River Basin System. Since Hungry Horse Reservoir is a part of this system, the alternative chosen for Columbia Basin System operations will directly affect the Flathead River and Flathead Lake.

RELATIONSHIP OF WATER QUALITY AND FOREST MANAGEMENT ACTIVITIES

Scientists have developed computerized simulation models that show predicted increases over natural sediment and water yields in drainages of the Flathead

River Basin as a result of logging practices. Sediment yield models suggest that the extent of some past logging and related activities, particularly road building on steep, unstable slopes, could yield abnormally large sediment loads in many of the basin's streams. Indeed, there is evidence that sediment loads in Coal Creek and other creeks have increased in relation to the intensity and duration of logging activities.

In 1988, the Department of State Lands, the Flathead National Forest, Plum Creek Timber Company, L.P., the Department of Fish, Wildlife and Parks, the Department of Health and Environmental Sciences' Water Quality Bureau, the University of Montana, and the Flathead Basin Commission established the "Flathead Basin Forest Practices/Water Quality and Fisheries Cooperative Program." A Coordinating Team administered the Cooperative Program, scientific study leaders directed each specific project, and resource specialists from various organizations provided technical assistance as needed. The Cooperative Program's specific objectives were (1) to document, evaluate, and monitor whether forest practices affect water quality and fisheries within the Flathead Basin, and (2) if detrimental impacts exist, to establish a process to utilize this information to develop criteria and administrative procedures for protecting water quality and fisheries.

Some of the conclusions from the *Flathead Basin Forest Practices Water Quality and Fisheries Program Final Report* follow.

- Timber harvest may cause spring runoff earlier in the year and higher peaks in spring discharge during above-normal runoff years.
- Past human land disturbance activities increased fine sediment deposition in Whitefish Lake from 1930-1970. However, recent logging activity in Swift Creek was not accompanied by increased sedimentation in Whitefish Lake. Roads accounted for most of the increased sediment transport and deposition in Whitefish Lake.
- Initial road construction and upgrading of the Going to the Sun Road from Lake McDonald to the continental divide at Logan Pass during the 1930s and 1940s were accompanied by substantial increases in sediment deposition in Lake McDonald. After the road was paved in the early 1950s the sediment deposition rate in Lake McDonald returned to background levels and has remained at background levels over the last 25 years.
- Timber harvest activity and attendant road building can lead to increased suspended sediment concentrations, higher concentrations of nutrients (nitrogen and phosphorus); more fine sediment in trout spawning gravels, increased gravel embeddedness, and greater algal growth in streams.
- Best Management Practices are generally better applied and more effective in the Flathead Basin than in the state overall. The greatest number of departures were related to road drainage and road maintenance, followed by failure to recognize and modify practices in the Streamside Management Zone.

(See also the section in this *Biennial Report* on the "Forestry Practices Cooperative Program.")

BEST MANAGEMENT PRACTICES

Section 319 of the Clean Water Act requires states to establish Best Management Practices (BMPs). These BMPs are cost-effective ways to reduce nonpoint sources of pollution. By following these voluntary environmental guidelines, land managers reduce the production of organic and inorganic sediments and nutrients, and avoid temperature changes resulting from management activities.

Best Management Practices have no value in protecting resources if they are not applied, are improperly applied, or are ineffective. Therefore, Montana has developed a process to audit forestry BMPs in the field. The audit results generate a qualitative assessment as to whether BMPs have been implemented and evaluate their effectiveness in keeping sediment out of streams.

Five-person teams with expertise in forestry, hydrology, engineering, silviculture, and fisheries have been rating the application and effectiveness of forestry BMPs on forest lands in Montana since 1987. In 1992, the state-wide audit teams looked at logging areas on state, federal, private industrial, and private non-industrial forest lands. They compared the ways logging operators built roads, left buffers of vegetation along streams, skidded logs, and performed other logging operations with the recommended Best Management Practices. The results from these state-wide audits seem to be similar to results from the Flathead Basin.

The 1992 state-wide audits show significant improvements in the application and effectiveness of forestry BMPs for all ownership groups when compared with the 1990 results.

- The application of practices that meet or exceed BMP requirements was 87% (compared with 78% in 1990).
- The application of high risk practices that meet or exceed BMP requirements was 72% (compared with 53% in 1990).
- The number of practices providing adequate protection (effectiveness) was 90% (compared with 80% in 1990).
- On average, there were 4.6 impacts per site (compared with 8 impacts per site in 1990).

Nearly every forestry BMP audit finds that the majority of problems result from roads and poor management adjacent to streams. Montana's new *Streamside Management Zone Act* (HB731) addresses these concerns and is expected to greatly reduce the water quality impacts of forest practices.

On the Flathead National Forest in 1989 and 1991, most of the departures from forestry BMPs were from a failure to apply BMPs rather than ineffective application. Also, some of the current timber sale and road contracts were written before the BMP guidelines, and therefore do not provide adequate control of nonpoint water pollution.

CONCLUSIONS

This report has not attempted to interpret thoroughly all the data in the water quality monitoring database. Rather, the researchers involved have identified and analyzed key findings. This is a progress report pertaining to the overall objective of monitoring water quality in the Flathead River Basin.

Much of the water in the Flathead River Basin drains out of pristine wilderness areas. Therefore it is not surprising that waters in the basin rank among the finest in the temperate regions of the world. Some of the lakes in Glacier National Park have the cleanest water reported in the scientific literature. In fact, Flathead Lake's water quality is ranked in the top ten percent for lakes of its size. In addition, the bull trout and westslope cutthroat fisheries are unique and valued assets of the Flathead River Basin. To protect this high quality system, scientists must continually monitor various water quality variables and resource managers must use these data to guide management decisions.

Although researchers found that Flathead River Basin waters are very clean, the rapidly increasing human population has undesirably affected the basin's waters. Researchers are concerned because they have identified a deterioration in the water quality and fisheries in the Flathead Basin. Some of the following conclusions highlight aspects of the decreased water quality.

A• Deep water discharges from Hungry Horse Dam have changed the temperature in the Flathead River downstream to Flathead Lake. Two effects are evident. (1) Rapid temperature change occurs during warm months when dam discharge varies. This rapid change is harmful to aquatic life. (2) Long-term cooling from deep water discharge has reduced trout growth potential by two to five times in the Flathead River and has affected the life cycles of insects (which are important food for fish).

B• Because of the high quality waters in the Flathead River drainage, aquatic plants and animals have naturally low productivity rates. Increases in productivity indicate declines in water quality. Therefore, the lake-wide trend of increasing primary production of phytoplankton (that is, the propensity of the lake to grow algae) is alarming. This trend suggests that algae and other microorganisms in the lake are being fertilized by excess nutrients from the drainage basin and from polluted precipitation that falls on the lake surface.

C• The increase in primary productivity may also be associated with the long-term dynamics of *Mysis* shrimp, and may therefore be related more to food web changes than to changes in nutrient loads. After *Mysis* shrimp appeared in the lake in 1981, the kokanee salmon fishery and the critical zooplankton population needed as forage for fish declined precipitously. These food web fluctuations have begun to stabilize — at least in terms of the abundance of *Mysis* shrimp and zooplankton. However, *Mysis* shrimp will continue to affect the ecosystem for many years.

D• Rain, snow, smoke, and dust annually drop 23 to 38 percent of Flathead Lake's total phosphorus load directly onto the surface of the lake.

E• Researchers believe the nutrient reduction programs of the Flathead Basin Commission and the Water Quality Bureau are working. However, such programs have not been in place long enough for the effects to be seen. Also, nutrient reduction cannot compensate completely for increasing loads of nutrients generated by the rapidly expanding population. Ashley Creek (which drains water from the Kalispell Sewage Treatment Plant) and Stoner Creek (which drains water from around Lakeside) continue to be major pollution sources.

F• Even though the chemical environment of the lake has not altered much over the years, Flathead Lake is at a critical threshold. If the concentration of nutrients such as nitrogen and phosphorus increases, water quality may deteriorate suddenly. (For example, increased nutrients might initiate lake-wide blue-green algae blooms.)

G• For the first time since limnological studies began on Flathead Lake in 1896, researchers have observed reduced dissolved oxygen levels in the bottom layers of the lake at Big Arm Bay. This is alarming because hypolimnetic oxygen reduction is a sign of cultural eutrophication (that is, lake enrichment from nutrient pollution).

H• The status of the water in Flathead Lake varies depending on the season. (For example, in the summer there is a reduced level of nitrogen in the upper water layers.) These dynamics occur lake-wide, but effects vary at the different sites.

I• The Flathead Lake Biological Station now has one of the longest records of limnological conditions in a large lake available anywhere in the world. Decision-makers have used this record for guidance (for example, related to phosphorus control strategies). However, researchers have not been able to monitor enough sites on Flathead Lake to detect all lake-wide water quality problems. They would not have discovered the reduced levels of dissolved oxygen in the bottom layers of the lake at Big Arm Bay if they had not received funding from the U.S. Environmental Protection Agency's Clean Lakes Program through the Montana Water Quality Bureau.

J• The Flathead Basin Commission's volunteer monitoring program provides useful data from several lakes in the basin.

K• Whitefish Lake is on the threshold of becoming more eutrophic. It continues to receive significant amounts of suspended sediments and algae-stimulating nutrients. Most of this load comes from the naturally unstable banks of Lower Swift Creek and from increased lakeshore development.

L• Researchers monitored various lakes in Glacier National Park to obtain baseline data for documenting changes in water quality. Overall, the lakes clearly reflected the pristine attributes that stimulated the creation of Glacier National Park and its designation as a Biosphere Reserve. These lakes will be extremely sensitive to increases in phosphorus levels and acid deposition caused by human activities.

M• Tributaries to the Flathead and Swan lake and river systems support what is probably the largest migratory population of bull trout in the world. The Montana Department of Fish, Wildlife and Parks has one of the longest records on bull trout populations available anywhere. Decisions about the status of this species may be significantly influenced by this record. Unfortunately, bull trout populations are declining seriously in tributaries to the North and Middle Forks of the Flathead River. The factors responsible for this decline may be difficult or expensive to control. For example, lake trout prey on bull trout and lake whitefish compete for food. Bull trout may also be affected by cold water releases from Hungry Horse Dam since the cold water facilitates the movement upstream of lake trout and lake whitefish. Bull trout populations in the Swan River system are the highest on record.

N• The Flathead River system supports one of the most important known populations of genetically pure westslope cutthroat trout. These fish are valuable, unique, and a vital part of the ecological integrity and quality of life in the system.

O• It is likely that trout populations in the Flathead Lake system had declined before the current monitoring program began. Dams block the paths of fish migrating from Flathead Lake. Access to nearly 60% of the habitat once available to westslope cutthroat and bull trout has been eliminated. In addition, past land use activities may have reduced fish populations.

P• The quality of fish habitats in some portions of the Flathead Basin has been moderately reduced. For example, the quality of Coal Creek streambed gravels in the North Fork Flathead drainage is only marginally acceptable for bull trout spawning and rearing. Some recovery of tributary fish habitats has occurred since 1989, probably due to the natural flushing of sediment from streams.

Q• Habitat degradation, fishing, hybridization, competition with non-native species, and the operations of Hungry Horse Dam could cause significant declines in the westslope cutthroat trout population. Currently, the population is relatively stable. The size and number of westslope cutthroat trout in the upper South Fork of the Flathead River now appear to be stable. This may be a response to the more restrictive fishing regulations imposed in 1984.

R• Although the food web in Flathead Lake appears to have stabilized in terms of *Mysis* shrimp and zooplankton, the kokanee salmon population remains below detectable levels. Also, for the first time, large numbers of lake trout and lake whitefish have appeared far upstream in the Flathead River. These pioneering fish may be eating young bull trout and crowding them out of their habitat. Researchers continue to study these changes and to propose solutions for mitigating the effects of the operations of Kerr and Hungry Horse Dams.

S• A continuing controversy in the basin is the relationship between logging and increased water, sediment, and nutrients in streams and lakes. The recently completed Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program study found that timber harvest activity and attendant road building can lead to increased suspended sediment concentrations, higher concentrations of nutrients (nitrogen and phosphorus); more fine sediments in trout spawning gravels; increased gravel embeddedness; and greater algal growth in streams. The observed relationships were complex and highly variable, but the findings reinforced the need for careful forest management in order to avoid cumulative effects.

T• More land owners and managers have been applying Best Management Practices. In addition, the 1992 audits of BMPs show significant improvements over the 1990 results in the application and effectiveness of BMPs for all ownership groups.

RECOMMENDATIONS

The monitoring data clearly show that the quality of water in the Flathead Basin is deteriorating. The quality of life and a sustainable economy depend on good quality water. Therefore, the future of the Flathead Basin depends on how well decision-makers understand the damaging effects of human activities and whether they heed the warning signs and adjust management activities accordingly.

1• Because of the thermal effects of discharges from Hungry Horse Reservoir, the Flathead Basin Commission should encourage public decision-makers to immediately fund a project for constructing a mechanism at the dam that would allow for water releases from various depths in the reservoir to reduce thermal effects below the dam.

2• The Bonneville Power Administration, U.S. Army Corps of Engineers, and Bureau of Reclamation are reviewing dam operations on the Columbia River System. They have been examining the river's many uses and analyzing how they interact and often conflict. After full scale analysis of the alternatives, this System Operation Review process will result in an Environmental Impact Statement and a plan for the Columbia River System that will best meet the region's needs. The Flathead Basin is at the headwaters of the Columbia River System, so changes in downstream management will affect the basin. Therefore the Flathead Basin Commission should continue its involvement with the Columbia River System Operation Review.

3• The Flathead Basin Commission should encourage all organizations to work cooperatively to respond to the Recommendations in this "Water Quality Monitoring Report." These organizations include the Confederated Salish and Kootenai Tribes, the Conservation Districts, the Corps of Engineers, the Environmental Protection Agency, Flathead County, Glacier National Park, Lake County, the Montana Department of Fish, Wildlife and Parks, the Montana Department of Health and Environmental Sciences' Water Quality Bureau, the Montana Department of State Lands, Montana Power Company, the United States Forest Service, and the United States Geological Survey.

4• The agencies identified in the "Master Plan for Monitoring Water Quality in the Flathead River Basin" must continue to cooperate with the Flathead Basin Commission in the monitoring of water quality variables and other activities.

5• The agencies identified in the "Master Plan" should maintain the current Flathead Basin monitoring program.

6• The agencies identified in the "Master Plan" should allocate more time for their scientists to work interactively with scientists from other agencies. They need to integrate their efforts to analyze the cumulative effects of human activities on water quality and the fresh-water ecosystem; to determine trends in the data; and to distinguish between natural and human-caused sources of water pollution.

7• The Flathead Basin Commission should encourage all land owners to cooperate through their local conservation districts or the Montana Cumulative Effects Cooperative in minimizing the cumulative effects of all land use activities which affect water quality.

8• The Flathead Basin Commission should seek funding for the monitoring program as proposed by the Technical Committee.

9• The Flathead Basin Commission should request that counties establish a mechanism to require developers in the basin to help provide funding for the water quality monitoring program.

10• The participants in the monitoring program are having greater difficulty each year maintaining their funding. The Montana Legislature may need to act to save the Flathead Basin Commission's water quality and fisheries monitoring program. Also, The U.S. Congress may be able to include a monitoring program for Flathead Lake and other nationally significant lakes into its re-authorization of the federal Clean Water Act in the 1993 session.

11• The Flathead Basin Commission should update its "Master Plan for Monitoring Water Quality in the Flathead River Basin" as needed based on the recommendations of the Technical Committee.

12• Researchers must continue to monitor key water quality and fisheries variables at important sites to evaluate the basin-wide goal of protecting aquatic resources. The Flathead Basin Commission should incorporate the sites identified by its Technical Committee into its "Master Plan."

13• The largest concern of researchers is the cumulative effects of *all* types of development activities in the basin and the sources of impaired water quality. The Flathead Basin Commission should modify its "Master Plan" to include more sites in an attempt to detect the differences between natural and human-caused changes in water quality. Some of these sites should be in tributaries of the Flathead River on the valley floor.

14• The Flathead Basin Commission needs to incorporate more sampling sites in Flathead Lake into its monitoring program because it appears that problems may not be detected with the current program.

15• Researchers need to carefully monitor the rate of reduction in oxygen levels deep in lakes to determine long-term trends and the relationship between oxygen reduction and nutrient loading from all sources.

16• The Flathead Basin Commission should establish a network of sampling stations to monitor the changes in the water quality of Whitefish Lake.

17• The Flathead Basin Commission should establish and maintain an integrated and interactive water quality and fisheries database.

18• The U.S. Geological Survey measures the discharge of Flathead Lake's major tributaries. The water quality monitoring program must have such data to determine such things as flow and pollutant load relationships. The Flathead Basin Commission should encourage the funding for the U.S. Geological Survey to maintain its streamflow gauging stations.

19• The Flathead Basin Commission should expand its use of volunteers to monitor water quality at some sites.

20• Since they will be extremely sensitive to acid deposition, several of the lakes in Glacier National Park should be monitored to detect changes from baseline levels.

21• The Flathead Basin Commission should consider petitioning the Montana Board of Health and Environmental Sciences to have critical bull trout spawning streams listed as National Resource Waters under the Montana Water Quality Standards and Nondegradation Rule.

22• Researchers should determine the genetic purity of bull trout in streams that support both bull trout and brook trout to determine the degree of interbreeding. They should collect these samples outside the sections used for annual monitoring of the number of fish.

23• The number of juvenile bull trout has declined at certain sites. Land owners and managers should restrict management activities to those which do not increase sediment loads to critical bull trout spawning streams.

24• The Flathead Basin Commission should encourage efforts to develop criteria related to the allowable amount of deposited sediment, percentage of fine sediment, substrate scores, bedload, and suspended sediment in critical bull trout and westslope cutthroat trout streams.

25• Best Management Practices (BMPs) have been developed to control nonpoint sources of pollution. However, BMPs have no value in protecting resources if they are not applied, are improperly applied, or are inadequate. Land owners and managers should continue to improve the application of Best Management Practices (along with other soil and water conservation practices) in the management of their lands.

26• The Flathead Basin Commission should study the effects of slash burning, wood stoves, wood heaters, natural fires, and other sources of smoke on the nutrient content of atmospheric deposition.

27• The Flathead Basin Commission should support funding for a study to determine whether BMPs effectively protect water quality.

28• The Flathead Basin Commission should intensify its efforts to inform individuals and organizations about how they can protect water quality in the Flathead Basin.

29• The Flathead Basin Commission should continue to inform public decision-makers of the key findings of the Flathead Basin Commission so they can develop strategies for limiting new and reducing existing pollution sources.

30• Individuals and organizations should encourage local governments to implement planning mechanisms that will minimize degradation of water quality.

31• Individuals and organizations should ensure that developers be held accountable for their cumulative effects on the basin's water quality and that they help fund the monitoring program.

32• Individuals and organizations should reduce their use of cleaning agents, fertilizers, pesticides, and other products harmful to the environment.

33• Individuals and organizations should voluntarily limit their use of wood stoves and wood heaters because the smoke contains phosphorus which pollutes surface waters.

34• Individuals and organizations should actively participate in monitoring water quality through the Flathead Basin Commission's Volunteer Monitoring Program and through other programs.

The efforts of the water quality monitoring committee are critical to the preservation of the basin's relatively pristine aquatic environment. Other public and private agencies and organizations should participate with them in their efforts to protect the Flathead River Basin's fresh-water ecosystem.

The water quality in the Flathead Basin is deteriorating. We must work together to stop the decline in water quality and preserve our quality of life.

COMMISSION BUDGET

The Flathead Basin Commission receives an annual appropriation from the Montana Legislature. In addition, the Commission actively seeks financial and in-kind support from other sources. The information provided below outlines the source of funding, contributions received, and how financial resources were allocated for the 1991-92 biennium.

FUNDING SOURCES 1991-92

Governor's Office staff support	$67,572	
State General Appropriation	13,736	
Bonneville Power Administration grant	12,500	
Coors Brewing Co. Volunteer Monitoring grant	2,100	
Flathead County in-kind assistance (office)	3,600	
Total Funding and other Assistance		$99,508

FUNDING ALLOCATIONS 1991-92

Staffing	$67,572	
Office operations and program support: Office supplies, postage, printing telephone, equipment repair, film purchase and processing, publications subscriptions, miscellaneous expenses	8,036	
Internship Program	5,500	
Monitoring Program equipment procurement and administrative support	4,800	
Re-publishing of Cooperative Program study	1,000	
Assistance to U.S. Geological Survey (U.S.G.S.) Whitefish and Stillwater rivers monitoring effort	2,000	
Basin Scientific Conference planning	500	
Flathead County Cooperative Planning Coalition public education process	500	
Biennial Report editing, printing	6,000	
Total Expenditures		$95,908

BONNEVILLE POWER ADMINISTRATION GRANT

In September of 1991, the Commission learned that due to a state budget shortfall of over $70 million, all state agencies were being mandated to reduce their budgets. As part of the budget reduction process, the Commission's annual state appropriated budget of $18,800 was cut by 63 percent to $6,868.

Commission ex-officio member George Eskridge, representing Bonneville Power Administration, initiated a request to the BPA to determine whether agency funds might be available to help the Commission make up for its funding reduction. John Merrill, Government Affairs Office with the BPA in Portland, worked with the Commission and Eskridge to formalize a two year grant of $25,000 to help sustain the Commission's activities.

The funds will be available in the amount of $12,500 per year for federal fiscal years 1992 and 1993. The BPA determined that the Commission's public role in the upper portion of the Columbia River system, with its special emphasis on public education, would prove compatible with the institutional interests of the agency. The funds will primarily be used to enhance and expand the Commission's public education capabilities in the basin.

MEMBERS OF THE FLATHEAD BASIN COMMISSION

Gil Lusk, Chair
Superintendent, Glacier National Park

Joel Holtrop, Chair, Monitoring Committee
Supervisor, Flathead National Forest

Jean Cumming
Citizen Member, Charlo

Larry Wilson, Vice-Chair
Citizen Member, Columbia Falls

Jerald L. Sorensen, Chair, Bi-Lateral Cooperation and Planning Committee
Lake County Land Services

Jeff Janke
Deputy State Forester, Montana Department of State Lands

Rick Bartos, Executive Director
Office of the Governor

John Lozeau
Councilman, Confederated Salish & Kootenai Tribes

William Gregg
Citizen Member, Polson

Elna Darrow, Chair, Education and Public Information Committee
Citizen Member, Bigfork

Sharon L. Stratton
Flathead County Commissioner

JoAnn Speelman
Citizen Member, Kalispell

Charles Abell
Citizen Member, Whitefish

William Engle
U.S. Environmental Protection Agency
Ex-officio Member

Rich Moy
Montana Dept. of Natural Resources & Conservation
Ex-officio Member

Dennis Christenson, Chair, Hazardous Materials Comm.
Supt. Hungry Horse Dam
Ex-officio Member

Robert T. O'Leary
Montana Power Company
Ex-officio Member

Dennis McDonald
B.C. Environment
British Columbia Liaison

George Eskridge
Bonneville Power Administration
Ex-officio Member

Dr. Loren Bahls
Montana Dept. of Health & Environmental Sciences
Ex-officio Member

Mark Holston, Staff
Public Information Officer

Steve Foster
U.S. Army Corps of Engineers
Ex-officio Member

Dan Vincent
Montana Department of Fish, Wildlife and Parks
Ex-officio Member

Appendix

Commission Resolutions

Resolution 1-91

Support Restoration of Federal Construction Grants Program

Approved by Flathead Commission vote on 9/23/91.

WHEREAS, the Flathead Basin Commission is a nonregulatory organization whose mission is the protection and preservation of water quality in the Flathead Basin; and

WHEREAS, water quality is essential to the quality of life and economic stability in the Flathead Basin; and

WHEREAS, inefficient and/or antiquated sewage collection and treatments facilities have the potential to severely degrade water resources and beneficial uses of water; and

WHEREAS, the cost of construction, reconstruction or improvements to sewage collection and treatment facilities in many cases is beyond the community's ability to pay; and

WHEREAS, the Clean Water Act of 1972 contained federal grants for sewage treatment facilities under the Construction Grants Program which provided $200 million to 149 Montana communities and improved water quality; and

WHEREAS, the Construction Grants Program was terminated by Congress and replaced with a loan program which causes financial hardship to many rural Montana communities as well as threats to Montana water quality;

THEREFORE BE IT RESOLVED that the Flathead Basin Commission supports restoration of the federal Construction Grants Program and shall communicate this support to the four members of the Montana Congressional Delegation.

Resolution 2-91

Encouragement Adoption of Forest Practices/Water Quality Study Recommendations

Approved by Flathead Commission vote on 9/23/91.

WHEREAS, the Flathead Basin Commission created and developed a study cooperative named the Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program; and

WHEREAS, the key members of the Cooperative included the major timberland managers in the Flathead (Flathead National Forest, the Montana Department of State Lands and Plum Creek Timberlands), along with nearly a dozen additional valuable contributors including the Montana Department of Health and Environmental Sciences and the University of Montana/Flathead Lake Biological Station and School of Forestry; and

WHEREAS, the purpose of the cooperative was to determine the impacts of timber practices on the Flathead's water quality, fisheries and aquatic life, and to recommend alternative harvest practices or actions to reduce these impacts; and

WHEREAS, the study leaders have issued reports which call for 34 scientific recommendations to reduce the impacts of timber harvests on water quality, and these recommendations are the result of intense review and discussion by study leaders; and

WHEREAS, the recommendations, if adopted by the three major timberland managers in the Flathead, will result in improved water quality and reduced impacts to fisheries and aquatic life in the Flathead's lakes, rivers and streams;

THEREFORE BE IT RESOLVED that the Flathead Basin Commission endorses the Cooperative study and study recommendations, and strongly encourages the timberlands managers to begin taking immediate steps to implement the recommendations contained in the study.

RESOLUTION 3-91
ENDORSEMENT OF WATER QUALITY PROVISIONS EMBODIED IN HUNGRY HORSE DAM MITIGATION PLAN

Approved by Flathead Commission vote on 9/23/91.

WHEREAS, the construction and operation of Hungry Horse Dam has resulted in fisheries losses caused by the blockage of fish migration patterns, downstream fish losses caused by water level fluctuations and reservoir losses caused by dam operations; and

WHEREAS, the Pacific Northwest Electric Power Planning and Conservation Act, as passed by Congress in 1980, created the Northwest Power Planning Council and charged the Council with mitigating for fish and wildlife losses suffered through the construction of hydro projects on the Columbia River System; and

WHEREAS, the Montana Department of Fish, Wildlife & Parks and the Confederated Salish and Kootenai Tribes have developed a comprehensive plan (Fisheries Mitigation for Hungry Horse Dam) for Council review, and;

WHEREAS, this plan has undergone extensive public involvement through the use of public meetings, public hearings, consultation group review and comment, detailed media coverage and full disclosure throughout the development of the plan and release of the plan to the Council; and

WHEREAS, the plan is designed to restore fish populations to the Flathead River system through the mitigation measures, other features of the plan provide for improved water quality protection and for improved aquatic life enhancement; and

WHEREAS, the mission of the Flathead Basin Commission is to protect and monitor the Flathead Basin's water quality and aquatic life; and

WHEREAS, the Commission has taken an active role in participating in public forums to endorse aspects of the mitigation plan as proposed by the department and tribes,

THEREFORE BE IT RESOLVED that the Flathead Basin Commission supports the streambank sedimentation and stabilization non-operational aspects of the mitigation plan and endorses the reductions in streambed erosion and siltation envisioned under the plan; and

FURTHER BE IT RESOLVED that the Flathead Basin Commission supports the operational components in the plan, specifically the selective withdrawal provisions, which will return 47 miles of the Flathead River system and Flathead Lake to natural water temperatures and restore the natural food chain and natural environment for aquatic life.

RESOLUTION 1-92
SUPPORT STATE WATER PLAN

Approved by Flathead Commission vote on 3/16/92.

WHEREAS, the Montana Constitution provides that the state shall maintain and improve a clean and healthful environment; and

WHEREAS, water quality is an integral part in the preservation and enhancement of a clean and healthful environment; and

WHEREAS, the Flathead Basin Commission was established with its primary mission to enhance and protect water quality in the Flathead Basin; and

WHEREAS, the Flathead Basin Commission has actively participated in developing the State Water Plan that recognizes a strong relationship between water quality and water quantity;

NOW THEREFORE, BE IT RESOLVED by the Flathead Basin Commission as follows:

1. Water quality is integrated into the allocation of water in Montana and such recognition requires careful and considered planning and allocation to protect existing and future beneficial uses of water, including private and public uses;

2. The Commission supports state action, including legislative, administrative and executive actions necessary to implement recommendations in the state water plan that recognizes the important relationship between water quality and quantity;

3. The Commission calls upon interested parties of the Flathead Basin to participate in a public open house to be held on April 21, 1992 at the Flathead County Courthouse East regarding groundwater and surface water quality and quantity.

COMMISSION RECOMMENDATIONS TO THE GOVERNOR AND LEGISLATURE

Recommendation One: The Commission supports and urges the passage of legislation drafted by the Environmental Quality Council entitled, "An act to generally revise the laws related to the management of lakeshores by local governments, amending sections 75-7-202 through 75-7-215 MCA."

Recommendation Two: The Commission requests that the Governor-elect continue Executive Order No. 1-92. This Executive Order recognizes the importance of the Department of Natural Resources and Conservation's involvement in the Commission's deliberations. Simultaneously, the Commission urges the passage of legislation to create a permanent position for a representative of Department of Natural Resources and Conservation on the Commission.

Recommendation Three: The Commission requests that the Governor-elect will continue Executive Order No. 18-92. The Commission has identified the transportation of hazardous materials and wastes along Montana waterways poses a substantial risk to water quality and natural resources of the Flathead Basin. Continuous effective operation of the Governor's Statewide Coordination Council on Transportation of Materials and Wastes is crucial to ascertaining and implementing necessary and reasonable precautions to protect Montana's waters and natural resources. Continued financial support of the Disaster and Emergency Services unit of the Dept. of Military Affairs to train, coordinate, and aggressively respond to spill incidents will effect proper and efficient containment that protects the public and natural resources.

Recommendation Four: The Commission recommends the current level of appropriations dedicated to the statutory mission of the Commission continue for the 1993-94 biennium.

Recommendation Five: The Commission adopts the North Fork Conceptual Strategy as the proper and appropriate land management guideline for the future development of the North Fork of the Flathead River. The Commission recommends the Governor-elect continue the composition and the mission of the negotiating team to meet and confer with representatives of the Province of British Columbia in an effort to finalize the zone of cooperation effecting the North Fork between Montana and B.C.

Recommendation Six: The Commission recommends the further study of the use of phosphorous-containing detergents within the Flathead Basin.

Recommendation Seven: The Commission recommends the Governor-elect continue seeking professional consultation regarding short and long-term highway usage of the east and west shores of Flathead Lake for commercial truck traffic. Professional consultation, as retained by the Department of Transportation, will work in concert with the Statewide Coordination Council for the Transportation of Hazardous Wastes and Materials.

Recommendation Eight: The Commission recommends the Governor-elect take necessary and appropriate action to influence the Environmental Protection Agency to place the Kalispell Pole Company site, located in Evergreen, on the national priority Superfund list for 1993. This matter is required to halt further groundwater contamination, similar to measures adopted in 1985 effecting the Somers Tie Plant. Failing acceptance by the Superfund list, efforts should be made to have the site added to the mini-Superfund list.

Recommendation Nine: The Commission recommends that the Governor-elect and the legislature support the final State Water Plan section on the integration of water quantity and quality and associated legislation that has been proposed based upon recommendations of the plan.

Recommendation Ten: The Commission urges the Governor-elect, through the Montana Department of Fish, Wildlife and Parks, to conduct a study to determine the effect of commercial fishing on Flathead Lake of its fisheries and other natural resources.

ESTABLISHING LEGISLATION

PART 3
FLATHEAD BASIN COMMISSION

75-7-301. Short title. This part may be cited as the "Flathead Basin Commission Act of 1983".
History: En. Sec. 1, Ch. 424, I, 1983.

75-7-302. Purpose. The purpose of the Flathead Basin Commission is to protect the existing high quality of the Flathead Lake aquatic environment; the waters that flow into, out of, or are tributary to the lake; and the natural resources and environment of the Flathead basin.
History: En. Sec. 2, Ch. 424, I, 1983.

75-7-303. Definitions. As used in this part, the following definitions apply:

(1) "Aquatic resources" means all beneficial uses of water, including but not limited to water quality and water supply; recreational, scenic, and aesthetic values; and fish, wildlife and other organisms.

(2) "Commission" means the Flathead Basin Commission established in 2-15-213.

(3) "Flathead basin" means all land and water areas the water from which drains into Flathead Lake or its tributaries.
History: En. Sec. 3, Ch. 424, I, 1983.

75-7-304. Duties of the commission. Duties of the commission are:

(1) to monitor the existing condition of natural resources in the basin and coordinate development of an annual monitoring plan. This plan must involve a cooperative strategy among all land and water management agencies within the Flathead basin and identify proposed and needed monitoring which emphasizes but is not limited to the aquatic resources of the Flathead basin.

(2) to encourage close cooperation and coordination between federal, state, provincial, tribal, and local resource managers for establishment of compatible resource development standards, comprehensive monitoring, and data collection and interpretation;

(3) to encourage and work for international cooperation and coordination between the state of Montana and the Province of British Columbia concerning the undertaking of natural resource monitoring and use of consistent standards for management of resource development activities throughout the North Fork of the Flathead River drainage portion of the Flathead basin;

(4) to encourage economic development and use of the basin's resources to their fullest extent without compromising the present high quality of the Flathead basin's aquatic environment;

(5) to, in the discretion of the commission, undertake investigations of resource utilization and hold public hearings concerning the condition of Flathead Lake and Flathead basin;

(6) to submit a biennial report to the governor and the appropriate committees of the legislature that includes:

  (a) a summary of information gathered in fulfillment of its duties under this section;

  (b) information on monitoring activities within the Flathead basin concerning the condition of the basin's natural resources, with particular emphasis on Flathead Lake;

  (c) the identification of land use and land development trends in the Flathead basin;

  (d) any recommendations the commission considers appropriate for fulfillment of its duties and for continued preservation of the Flathead basin in the present high quality of its aquatic resources; and

  (e) an accounting of all money received and expended, by source and purpose, for the period since the last report; and

(7) to meet at least semiannually within the Flathead basin, alternating the meeting site between the cities of Kalispell and Polson.
History: En. Sec. 7, Ch. 424, I, 1983.

75-7-305. Commission authority.

(1) The commission may make recommendations to the legislature and the governor and to federal, tribal, provincial, and local agencies for maintenance and enhancement of the quality of natural resources of the Flathead basin.

(2) Subject to appropriation by the legislature, the commission may receive and expend donations, gifts, grants, and other money necessary to fulfill its duties.
History: En. Sec. 8, Ch. 424, I, 1983.

75-7-306. Establishment of account. There is established in an other special revenue fund a Flathead Basin Commission account. Money received by the Flathead Basin Commission under 75-7-305 and such other funds as are designated or appropriated for its use must be deposited in the account.
History: En. Sec. 9, Ch. 424, I, 1983, and Sec. 48, Ch. 281, I, 1983.

Compiler's Comments
1983 Amendment Substituted "an other special revenue fund" for "the federal and private revenue fund".

75-7-307. Special county government authority. The governing body of any county within or bordering upon the Flathead basin may allocate to the Flathead Basin Commission a portion of any money available from coal severance tax allocations or other sources and designated for planning activities.
History: En. Sec. 10, Ch. 424, I, 1983.

75-7-308. Cooperation with other agencies and organizations. To fulfill its duties, the Commission shall develop and maintain cooperative programs with federal, state, provincial, tribal, and local agencies or organizations that are responsible for natural resource management and monitoring in the Flathead basin. Participating federal and provincial agencies must be requested to provide adequate funds to participate on the Commission and to monitor resources within their areas of responsibility.
History: En. Sec. 11, Ch. 424, I, 1983.

FLATHEAD RIVER PLANNING EFFORT

**DRAFT MEMORANDUM OF UNDERSTANDING BETWEEN
THE NATIONAL PARK SERVICE AND
FLATHEAD COUNTY AND
THE FLATHEAD BASIN COMMISSION AND
THE FLATHEAD REGIONAL DEVELOPMENT OFFICE AND
THE FLATHEAD CONSERVATION DISTRICT AND
THE MONTANA DEPARTMENT OF FISH,
WILDLIFE AND PARKS AND
THE MONTANA DEPARTMENT OF STATE LANDS AND
THE FLATHEAD NATIONAL FOREST**

ARTICLE 1. BACKGROUND AND OBJECTIVES

Whereas, Flathead County; the Flathead Basin Commission; the Flathead Regional Development Office; the Flathead Conservation District; the Montana Department f Fish, Wildlife and Parks; the Montana Department of State Lands; and the Flathead National Forest are currently engaged in preliminary planning for the management and conservation of natural and cultural values in the Flathead River Valley with other interested agencies and parties; and

Whereas, the Department of the Interior is directed, through Section 8 of the National Trails Act of 1968 (P.L. 90-543, as amended), Section 8 of the Wild and Scenic Rivers Act of 1968 (P.L. 90-542, as amended) and the Outdoor Recreation Coordination Act of 1963 (P.L. 88-29) to provide encouragement and assistance to states and local agencies and private interests to such river conservation and management; and

Whereas Flathead County has requested assistance on the Flathead River multi-objective management project from the National Park Service of the Department of the Interior;

Therefore, the National Park Service agrees to assist Flathead County; the Flathead Basin Commission; the Flathead Regional Development Office; the Flathead Conservation District; the Montana Department of Fish, Wildlife and Parks; the Montana Department of State Lands; and the Flathead National Forest in the development of a multi-objective management plan in accordance with the following terms and conditions.

ARTICLE 2. STATEMENT OF WORK

The goal of this cooperative project will be to develop a multi-objective management plan for the Flathead River from the confluence of the South Fork and Middle Fork to the river's inlet on the north end of Flathead Lake. This plan will reflect the interests and concerns of and be agreeable to the agencies, organizations and individuals who have a strong interest in the plan. To this end, Flathead County; the Flathead Basin Commission; the Flathead Regional Development Office; the Flathead Conservation District; the Montana Department of Fish, Wildlife and Parks; the Montana Department of State Lands; and the Flathead National Forest and the National Park Service will work with each other and with other public and private interests.

Flathead County agrees to:

1. Offer meeting space at no charge for public hearings and presentations.
2. Hold hearings at the planning board and commissioner level when and if such hearings are necessary and appropriate.
3. Act as sponsoring agency for the purposes of the project.

The Flathead Basin Commission agrees to:

1. Provide appropriate support for the project consistent with the mission and policies of the Commission.
2. Assist in facilitating the project through allocation of staff time and resources consistent with maintaining the Commission's ability to adequately address its other responsibilities.
3. Encourage the active participation of Commission members in the project.
4. Make any appropriate Commission documents and data available to the project upon request.
5. Given the Commission's commitment to public involvement and education, support

and encourage public participation in the process through means available to the Commission, including public pronouncements, facilitating media coverage, et cetera.

The Montana Department of Fish, Wildlife and Parks agrees to:

1. Offer meeting space at no charge fore public hearings and presentations.
2. Provide appropriate support for the project consistent with the mission and policies of the Department.
3. Assist with the project through allocation of staff time and resources available through the Department.
4. Assist in the definition of issues and concerns associated with management of this multi-objective planning process.
5. Assist with the dissemination of information pertaining to the public planning process of the project.

The Montana Department of State Lands (DSL) agrees, within the limits permitted by available budget and staff, to:

1. Provide information currently available to DSL in a format suitable for use in the multi-objective management plan.
2. Assist in the identification of issues and concerns of the general public and interested parties to be considered in the planning process.
3. Assist in the identification of significant resources and their values, particularly on lands owned by DSL.
4. Review draft products during the development of the management plan and provide appropriate comments.

The Flathead Conservation District agrees to:

1. Provide support for the multi-objective management plan, consistent with the mission and policy of the FCD, contingent upon demands of other previous priorities.

Flathead National Forest agrees to support the cooperative project through:

1. Technical services, maps, photos.
2. Input from personnel where appropriate skills are needed on an intermittent basis.

The National Park Service agrees to:

1. Assist with the development of an overall planning and public involvement strategy.
2. Help identify issues and concerns from the general public and interested parties to be considered in the planning process.
3. Provide direction in the identification of significant resources and their values.
4. Assist in developing conservation strategies and use analysis identified in the public involvement process.
5. Assist in developing and documenting plan alternatives.
6. Assist in the writing and publication of a plan.

ARTICLE 3.

This agreement will be in effect from October 1, 1992 to September 30, 1993 with a joint understanding that this project will reasonably carry over to the next two fiscal years contingent on funding.

ARTICLE 4. AWARD

Flathead County; the Flathead Basin Commission; the Flathead Regional Development Office; the Flathead Conservation District; the Montana Department of Fish, Wildlife and Parks; the Montana Department of State Lands; the Flathead National Forest and the National Park Service each agree to contribute the services of professional and support staff to the project. All agencies will also provide funds necessary to accomplish their own responsibilities as specified in this agreement, including funding for travel, printing and other project costs. Federal assistance will be limited to the advice and consultation of National Park Service staff; no funds will be transferred from the National Park Service to Flathead County; the Flathead Basin Commission; the Flathead Regional Development Office; the Flathead Conservation District; the Montana Department of Fish, Wildlife and Parks; the Montana Department of State Lands; or the Flathead National Forest to accomplish this agreement.

ARTICLE 5. Prior Approval

The Recreation Resources Assistance Division of the National Park Service has approved the use of fiscal year 1993 River and Trail Conservation Assistance Program funds for this project.

ARTICLE 6. Termination

This agreement may be terminated by either party with 30 days written notice of the other.

ARTICLE 7. Required Clauses

During the performance of this agreement, the participants agree to abide by the terms of Executive Order 11246 on nondiscrimination and will not discriminate against any person because of race, color, religion, sex or national origin. The participants will take affirmative action to ensure that applicants are employed without regard to their race, color, religion, sex or national origin.

No member or delegate to Congress, or resident Commissioner, shall be admitted to any share or part of this agreement or to any benefit that may arise therefrom.

Flathead Lake against the backdrop of the Mission and Swan mountain ranges.

For Further Information about the Flathead Basin Commission, contact:

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